

CHAPTER IV.

AGRICULTURE.

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ACCORDING to the 1881 census, agriculture supports about 600,000 people or sixty-eight per cent of the population. The details are :

Dhárwár Agricultural Population, 1881.

AGE.	Males.	Females.	Total.
Under Fifteen ...	117,227	111,979	229,206
Over Fifteen ...	187,850	192,088	379,938
Total ...	305,077	304,067	609,144

HUSBANDMEN.

Dhárwár husbandmen are Lingáyats, Maráthás, Musalmáns, Bráhmans, Kurubars, Lavánás or Lambánis, and Mhárs. Of these the Lingáyats are by far the richest and most important. The headmen of villages are usually Lingáyats, and the Lingáyats form the bulk of the cultivators of Dhárwár, as Marátha Kunbis form the bulk of the cultivators of Khándesh, Násik, and the North Deccan. The Lingáyat husbandman differs both in body and mind from the Marátha husbandman of the North Deccan. He is a South Indian with a smaller northern strain even than the Marátha. He is larger stronger and blacker, a harderworker, with more forethought and with a strong turn for trade speculation.¹ He is well disposed, intelligent, and enterprising, and is shrewder than a casual observer would imagine. As a body Dhárwár Lingáyat husbandmen are better off than north Deccan Kunbis, and very much freer from debt. They have passed through many changes within the last hundred years. To them, which it was not to the north Deccan Kunbi who had his share of the spoil, Marátha rule was an unmixed evil. For many years after the introduction of British peace and order the curse of rack-renting handed down by the Maráthás kept the husbandman deep in poverty. With the introduction of the revenue survey and the opening of roads between 1840 and 1850 their state improved. Between 1862 and 1871 came the great rise in value of all field produce, especially of American or saw-ginned Dhárwár cotton, which alone, according to Mr. Walton, in those ten years enriched the district by about £8,150,000 (Rs. 8,15,00,000). Between 1862 and 1865, no less than £4,700,000 (Rs. 4,70,00,000) or a yearly average of £1,175,000 (Rs. 1,17,50,000) were amassed by the growers and dealers in Dhárwar American cotton.² Dealers

¹ Bom. Gov. Sel. CXLVIII, 96-97.² Walton's Dhárwár Cotton, 73.

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backed by Bombay speculators paid as much as £10 (Rs. 100) the acre for planted cotton fields. The flood of wealth turned the people's heads. They did not know what to do with their money. At village festivals, numbers of landholders appeared with carts the naves of whose wheels were rounded with bands of silver.¹ Since 1871 many have impaired those gains by unwise cotton speculation, by extravagance, and by mismanagement. At the same time the price of cotton has fallen; years of scarcity and famine have wasted the district; and revised settlements have greatly added to the land tax. Still in spite of their loss and suffering from the 1876 famine the mass of the husbandmen of the cotton plains are (1884) well-to-do. Many Lingáyat husbandmen have large holdings. In the north Deccan the business of tilling the soil and of trading in its produce as a rule are distinct; in Dhárwár the two are to a large extent united. Not only does the landholder often take his produce to distant Kárwár or Kumta, he either brings back goods for the sake of the hire, or himself invests in such coast produce as finds a ready inland sale. Many Lingáyat landholders are moneylenders and cotton ginnerers, and many among them hoard stores of grain, which they sell at a high profit in times of scarcity. They generally keep a small staff of permanent farm servants to plough and look after their cattle, and at times temporary labour is largely employed for weeding and reaping.

Colonies of Maráthás are mixed with Lingáyats in many parts of the district, and scattered Marátha families also occur in a large proportion of villages. The Maráthás seem less well off than the Lingáyats and have less the knack of making money by moneylending, grain dealing, and cotton trading. The protection to creditors given by the civil courts is said to be the cause of the indebtedness of the poorer husbandmen, but indebtedness is less general than among north Deccan husbandmen. Musalmán husbandmen, of whom there are many, as a rule, have small holdings, and are not prosperous. Bráhmaṇ husbandmen are few, though a good many Bráhmaṇ pleaders and retired Government servants invest their savings in buying the occupancy right of fields. These Bráhmaṇ landholders do not till with their own hands. They either let the land or have an agent to manage its tillage. If the land is let the tenant pays the over-holder sometimes in money and sometimes in grain. If, as is the rule when the overholder is an absentee, the rent is paid in money, it amounts to two or three times the Government assessment. When the rent is paid in kind the tenant does not pay the Government assessment unless he is bound to pay it by a previous contract. As a rule the landlord recovers from the tenant one-third to one-half of the whole produce. The Kurubars or Shepherds and the Bedars or Hunters and now watchmen, form a considerable section of the husbandmen. As husbandmen they are careless and stupid, content with small results, and seldom rich or prosperous. A few of the wild pack-bullock and

¹ Bom. Gov. Sel. CXLVIII. 104.

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wood-cutting Lavánás or Lambánis, hold land in the west of the district, and here and there a few Holáis or Mhárs cultivate.¹

For tillage purposes the district is divided into the *malládu* or *malnád* that is the damp west and the *beilu shime* or dry east. The *malládu* is the tract on the border of the Kánara forests in the west and south-west of the district. It is subject to frequent and heavy rain. It is most favourable to the growth of rice and sugarcane, which, to succeed at all, must have abundant moisture. In these western lands the usual dry-crops of the open eastern plain are seldom grown. The only dry-crops are the coarse hill grains, *rági* Eleusine corocana, *sáve* Panicum miliare, *navani* Panicum italicum, and *jola* Sorghum vulgare. Of these *rági* and *sáve* are grown in comparatively small quantities, and *navani* and *jola* are sown only in two or three fields in a village and often not at all. In the *beilu shime* or dry eastern plain rice is seldom or never grown and sugarcane is grown only as a garden crop. The soil is best suited for dry-crops especially for cotton, gram, and wheat. Along the eastern fringe of the wet west lands, through the whole length of the district, from north-west to south-east including the towns of Dhárwár Hubli Bankápur and Kod, runs a belt of country which as regards soil climate and vegetation unites the characteristics of the moist hilly west lands and the dry eastern plains. In this transition region the soil is generally a reddish alluvial clayslate crossed here and there in an easterly direction by narrow belts of black cotton ground. This black soil is of superior richness probably owing to the mixture of particles of red soil, which, without changing the appearance and character of the black soil, lessen its clayeyness and increase its power of taking in water. Towards the east of this belt the rainfall is too scanty and uncertain for the growth of rice. So, also, towards the south-west the climate becomes too moist for dry-crops, and *rági* and other poor grains take the place of millet. In parts of this transition tract, dry and wet crops are often sown in the same field, so that, if the season proves too dry for rice, a crop of millet may save the landholder from complete loss. In Kod and Hángal in the south of this tract a number of large lakes water much rice and garden land. In some villages, on the eastern border of this tract, tobacco grows freely; in others the cultivation of chillies is carried on with great success. In the *malládu* or rainland, wherever the underlying laterite does not rise to the surface, the soil is good. The best soil called *kagadali* is a red mould formed of a fine iron-bearing gravel mixed with quartz pebbles and clay slate. Where the chlorite schists and clay slates predominate the soil is a light coloured loam of great depth called *jeddi mannu*. When untilled for many years the red soils often assume a most deceiving appearance. The surface soil is washed away and either a coating of loose gravel and quartz stones, or a thin layer of hardened clay is left into which water hardly passes and on which even grass hardly grows. The soil close under the surface, if long undisturbed, becomes hard and dense and seems almost proof against water. But after the merest surface scratching, the rain is able to

¹ Chiefly from materials supplied by Mr. F. L. Charles, C.S.

remain on the surface and soften the under soil, which can be deeply ploughed with the greatest ease, and, with a little manure, is extremely fertile. The light soil or *jeddi mannu* is the true rice soil. The earthy matter of this rice soil, as in west Bankápur, is chiefly decayed clay slate. By the action of water, tillage, and weather, it becomes a stiff, compact, light-coloured clay, so retentive of moisture, that in most of the lower lands water is found throughout the year a few feet below the surface. The soil on the highest and most open lands has little depth, and, even with manure and care, yields only one poor crop of rice in the year. Between the highest and the lowest situations, the soils are fairly deep, and, in seasons of abundant or even of average rainfall, generally hold moisture enough to yield a crop of pulse after the main rice harvest is over. The soil in the valleys or low lands is of superior richness. It is black or a rich dark brown and may almost be classed under the head of alluvium. This soil yields luxuriant after-crops, and its abundant moisture makes it specially suited for sugarcane. The best rice land is in several respects more valuable than the black cotton soil. The best rice land has much moisture, while the cotton land has no means of irrigation; the best rice land only occasionally wants manure, the cotton land wants manure every third year; the rice land seldom wants the labour and cost of ploughing, the cotton land must be ploughed every year. The best black soil sometimes yields a second crop, the best rice soil always yields a second crop and this with less labour than the black soil. To prepare the black soil for a second crop it has to be ploughed, broken by the *kunti* or heavy hoe, levelled with the *ballesal kunti* or light hoe, sown with the seed drill or *kurgi*, and once more levelled with the light hoe. In the best rice land the field is simply ploughed once, is closely sown by the hand, and to cover the seed the *korudu* or leveller is run over the surface.

By far the greater part of the open country is black ground or *yeri bhumi*. Its qualities are admirably suited to the dry climate of the tableland. Its great power of holding moisture enables its crops to bear unharmed seasons of drought which would prove fatal to any crop on the red soil. In these black soils nature to a great extent does what in other soils is left to the plough. In the hot weather, as the soil shrinks, it becomes fissured with cracks, two or three inches wide and about eighteen inches deep which divide the surface into blocks two to three feet square. The first heavy rainfall washes the surface soil into these cracks, and fills them removing the surface soil and exposing a fresh under-layer. Except sometimes in fields intended for cotton, instead of the plough the people use the heavy hoe or *kunti* drawn by two or four bullocks. This loosens the surface three or four inches deep and uproots what weeds there are though weeds are few in cleanly kept fields. Rain loosens the soil to a considerable depth and this scarping is enough in ordinary years. Once in six, seven, or eight years the plough is used to uproot deep-seated heavy weeds and to disturb the subsoil. When it gets covered with matted grass and *bábhul* scrub the surface becomes cut in deep water runs and pitted with holes and cracks. It is also covered with minute lime nodules which as they show

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through the grass make the soil look white and glary. The chief black-soil crops are cotton, wheat, gram, oilseeds, and the later varieties of Indian millet. Except a few gardens at Annigeri in Navalgund, and some other villages with patches of brown soil no watered land occurs over the whole black plain. To the general black soil character of the eastern plain the Kappatgudd hills form an exception. There the soil is stony red alluvial called *kennela* or *musári* somewhat like the reddish soils of the hills near Dhárwár and Hubli. Similar soil occurs among the granite ranges and rocks to the south-west of the Kappatgudd range towards the Varda river. In the east of Ránebennur is much stony and unarable soil called *kallunela* or *dáre* in which angular nodules of stone lie so close packed that the plough can hardly enter.

ARABLE AREA.

Of an area of 4612 square miles or 2,953,037 acres, 2,858,678 acres or 96·80 per cent have been surveyed in detail. Of these 169,738 acres or 5·93 per cent are the lands of alienated villages. According to the revenue survey, the rest contains, 2,271,057 acres or 79·44 per cent of arable land; 42,882 acres or 1·50 per cent of unarable; 47,168 acres or 1·65 per cent of grass or *kuran*; 176,606 acres or 6·17 per cent of forest; and 151,227 acres or 5·29 per cent of village sites roads and river beds. Of the 2,271,057 acres of arable land in Government villages 621,294 or 27·36 per cent are alienated. In 1882-83 of the arable area of 1,652,216 acres in Government villages, 1,503,011 acres or 90·97 per cent were held for tillage. Of this 6963 or 0·46 per cent were garden land; 86,873 acres or 5·77 per cent were rice land; and 1,409,175 acres or 93·75 per cent were dry-crop land.

HOLDINGS.

In 1882-83 the total number of holdings was 77,478 with an average area of about twenty-eight acres. Of the whole number 7675 were holdings of not more than five acres; 11,937 were of six to ten acres; 22,575 of eleven to twenty acres; 26,976 of twenty-one to fifty acres; 6145 of fifty-one to one-hundred acres; 1674 of 101 to 200 acres; 294 of 201 to 300 acres; 94 of 301 to 400 acres and 108 above 400 acres. The details are:

Dhárwár Holdings, 1882-83.

SUB-DIVISION.	Up to 5 Acres.	6 to 10 Acres.	11 to 20 Acres.	21 to 50 Acres.	51 to 100 Acres.	101 to 200 Acres.	201 to 300 Acres.	301 to 400 Acres.	Above 400 Acres.	Total.	Rental.	Area.
											£	Acres.
Dhárwár ...	778	1335	2710	2194	398	67	14	7	8	7511	27,790	170,633
Hubli ...	432	667	1649	2186	557	153	27	5	8	5684	25,822	180,625
Navalgund ...	546	1101	2764	4023	989	308	61	22	31	9845	38,306	346,250
Gadag ...	339	961	2732	4290	1148	350	63	23	25	9081	25,860	335,411
Bankapur ...	741	1046	1692	1936	426	127	26	7	6	5997	19,996	176,149
Ránebennur ...	336	684	1624	2237	480	108	6	4	...	5479	16,270	151,987
Hängal ...	1340	1361	1697	1339	248	76	12	2	...	6075	18,549	113,587
Karajgi ...	430	809	1971	2627	603	145	29	7	9	6630	19,599	200,640
Kalghatgi ...	962	1467	1519	1080	184	52	4	2	3	5273	12,731	91,606
Kod ...	1445	1869	2623	2568	343	56	8	...	1	8913	18,376	169,194
Ron ...	326	647	1544	2496	769	232	44	15	17	6090	16,421	220,806
Total ...	7675	11,937	22,575	26,976	6145	1674	294	94	108	77,478	239,720	2,156,888

STOCK.

In 1882-83 the farm stock included 40,872 carts, 89,323 ploughs, 258,510 bullocks, 151,379 cows, 40,523 he-buffaloes, 83,452 she-buffaloes, 5478 horses including mares and foals, 6819 asses, and 231,125 sheep and goats. The details are:

Dhárwár Farm Stock, 1882-83.

SUB-DIVISION.	CARTS.		PLOUGHS.		OXEN.	COWS.	BUFFALOES.		HORSES.	SHEEP AND GOATS.	ASSES.
	Rid- ing.	Carry- ing.	Two Bul- lock.	Four Bul- lock.			He.	She.			
Dhárwár ...	177	4614	8547	1126	23,982	15,482	5526	11,126	904	16,237	509
Hubli ...	162	4396	5144	336	17,562	8066	2268	7424	484	13,888	1313
Navalgund ...	47	2948	2363	419	20,446	6962	1729	7392	500	26,005	1047
Gadag ...	91	4470	7206	1449	28,533	12,289	2835	9630	519	48,616	797
Bankápur ...	11	4020	8222	712	23,272	15,218	4747	8597	564	12,996	354
Rānebennur ...	15	3111	7043	2181	23,646	12,499	2010	9459	419	31,619	1305
Hāngal ...	8	3075	8791	158	23,152	18,954	5840	6819	403	9936	150
Karajgi ...	21	3718	7320	1726	24,194	14,216	2761	9791	551	29,145	389
Kalghatgi ...	59	2444	7822	2	22,781	17,747	6230	5514	463	4725	281
Kod ...	11	3895	12,696	1791	34,801	23,224	5139	11608	382	18,007	239
Ron ...	5	2574	3734	635	16,141	6812	1438	6082	289	20,851	435
Total ...	607	40,265	78,788	10,535	258,510	151,379	40,523	83,452	5478	231,125	6819

One pair of oxen can till six to eight acres of rice land, ten to fifteen acres of ordinary dry-crop land, and thirty to forty acres of black soil. Thirty-two acres of black soil and eight acres of common soil or fifteen acres of common soil and five acres of garden land would enable a husbandmen to live like an ordinary retail dealer. In good years a man with a holding of this size might save; but as a good year does not come oftener than once in five years, the owner of so small a holding would find it difficult to save much.

The Poona-Harihar road, which runs north-west and south-east, divides the district into two belts, the hilly and woody west rich in water both for drinking and for tillage, and the open waterless east. Parts of Navalgund and Ron, in the eastern plain, which are crossed by the Bennihalla, are particularly badly off for water. The small streams dry early in the hot season, and what water is found by digging in their beds is too brackish for drinking. The well water is also apt to grow brackish. So short is the supply that from March to May the people of each caste form themselves into a water club, and every two or three days fetch water in bullock or buffalo carts from a distance of two or three miles. The dryness of these parts is not of recent date. Under the Peshwás (1756-1817), officers who fell into disgrace were often sent to govern this waterless or *nirjal* land. Irrigation is chiefly from ponds and reservoirs, in some cases with the help of canals. The pond system of irrigation is common in Madras and Maisur, but is rare in the Bombay Presidency. Three conditions favour the multiplying of ponds and reservoirs in west and south-west Dhárwár: the abundance of suitable sites, the certain and long continued local rainfall, and the absence of under-ground water. The stream beds and valleys among the low ranges of metamorphic schist supply numerous sites suitable for storage lakes. In the western subdivisions of Hāngal, Kod, Kalghatgi, and Bankápur seldom more than four and often not more than two months in the year pass without rain. The absence of under-ground springs seems to be due to the uprightness or highly inclined position of the clay slate and associated rocks which if flatter might have formed water-bearing strata. Except below ponds wells are rare.

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Reservoirs.

Most of the ponds and reservoirs are old works. It is not known when and by whom they were made. But most are believed to date from the Vijayanagar or Anegundi kings (1335-1570) who were famous for their success in water works. Almost all traditions of local prosperity centre in the first half of the sixteenth century, the reign of the great Krishna Ráya (1508-1542) who was famous for the number and magnitude of his public works.¹ During his reign the great lake near Shiggaon five miles north of Bankápur and other fine reservoirs are said to have been built. The most remarkable work, which is said to have been planned and carried out by a minister named Damak Mudh, was the damming in no less than seven places of the half mile broad Tungbhadra. Across this great river dams or *bandárás* formed of gigantic blocks of stone, often many tons in weight, were thrown. From five of these huge works canals, led along both sides of the river, water many miles of garden which are now the richest parts of Belári on the south bank and of the Nizám's country on the north bank of the Tungbhadra.² In 1881-82 there were 2979 ponds and reservoirs or one pond for every 1.52 square miles. Of these 1021 were in Kod, 841 in Hángal, 399 in Kalghatgi, 329 in Bankápur, 129 in Dhárwár, 105 in Hubli, ninety-nine in Karajgi, twenty-four in Navalgund, twenty in Gadag, and twelve in Ránebennur. These together water 93,730 acres of land paying a total assessment of £29,625 (Rs. 2,96,250). Of the whole area 87,246 acres were rice lands with a total assessment of £25,054 (Rs. 2,50,540), 5275 acres were garden lands with a total assessment of £4437 (Rs. 44,370), and 1209 acres with a total assessment of £134 (Rs. 1340) assessed at dry crop rates are now watered. The average assessment on each pond is about £10 (Rs. 100) and the area watered from ponds is 7.06 per cent of the whole tillage. The average area watered by each pond is thirty-one acres. Some ponds water the lands of only one or two holders, others water fifty to eight hundred acres often in several villages. These reservoirs as a rule are formed by a low and often irregular dam. They often depend for part of their water on the escape from higher lakes. Often, also, the natural catchment area is increased by catch-water drains or by supply channels from streams. As a rule the waste-water escapes are simple channels cut in the hard soil or gravel. They are generally at the end of a long arm of the pond to avoid breaching the main dam. The outlet sluices, of which the larger reservoirs have generally one or two, are made under and through the dam. These outlets are often masonry works with horizontal holes, stopped with wooden plugs, and surmounted by elaborately carved guide stones for the pole of the plug. Sometimes, especially in the smaller reservoirs, the water is let out by a simple cut through the dam, the opening being roughly filled with earth, stones, and brushwood. The larger lakes are almost always faced in front with walls of dry rubble stone. Below each reservoir

¹ Probably as in other dynasties, Krishna Ráya the greatest of the line has in tradition the credit of the works made by all the members of the family.

² Bom. Gov. Sel. CLV. 74.

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the land is laid out in terraces, and the distribution of water is managed entirely by the people, disputes being settled in ordinary cases by the leading members of the village and in grave cases by the officers of the irrigation department. Most of these reservoirs dry soon after the rains are over, the water being drawn off for rice and other early crops during the breaks in the rains. This practice is necessary to make good the difference between the usual local fall of about thirty inches and the sixty inches which without the help of irrigation rice requires. The watering power of a reservoir depends on its position as well as on its size. In the west where the rainfall is heavy the amount of water which can be drained off a lake and used in watering is much greater than in the dry east.

Some of the ponds though their supply of water does not last throughout the year, are used for watering garden crops. In this case the people have to trust either to the water in wells sunk below the dam, or to the rain-storms of March and April to help the crops through the time when the reservoir is dry. The chief garden crops under these ponds are betel and cocoa-palms, plantains, betel vines, and sometimes sugarcane. The evil of the pond system is that the ponds slowly but gradually have their storage capacity lessened by the deposit of silt. Formerly the landholders, who used the water of the lake, made yearly contributions in money or in labour to remove the silt. This practice has long ceased. Government are now often asked to be at the expense of removing silt deposit, but the clearing of silt is a very costly and unproductive mode of increasing storage. The effect of years of silting can generally be counteracted by slightly raising the whole water surface by adding to the height of the crest of the dam. The only advisable silt clearance is what is required to raise the crest of the dam or to keep the dam in repair. As regards the repairs of these lakes the principle adopted by Government has been to leave the ordinary repairs to the people who profit by the work. When for the proper maintenance of the works large repairs, raising the dam crest, widening the waste weir, or repairing outlets, have become necessary, Government step in and do the work. In such cases a contribution from the villagers used generally to be levied. Since 1880-81 Government have decided to undertake all such repairs at their own cost. Petty repairs to catch-water drains and to water-channels are still left to the people. Repairs and improvements to masonry works are always undertaken by Government. In the case of improvements either a contribution is asked from the villagers or an agreement is taken from them to pay such extra rates or irrigate such extra land as may be required to make the proposed improvements pay. During the ten years ending 1881-82 the total amount spent on repairs was £11,421 (Rs. 1,14,210).

Of the 2979 ponds and reservoirs the chief are at Háveri in Karajgi, at Nagnur in Bankápur, and at Dambal in Gadag.

The Háveri lake, about seven miles south of Karajgi is one of the largest and most important reservoirs in the district. It has a catchment area of sixty-nine square miles in which are many other ponds and reservoirs. It rarely fails to overflow every year, and

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when full its area is 647 acres. The work is provided with two waste weirs of a total length of 350 feet. In 1881-82 the lake watered 515 acres assessed at £509 (Rs. 5090).

The Nagnur lake in Bankápur has an earthen dam whose water face is protected by a massive dry-stone wall. The dam is 3400 feet long, and has a greatest height of twenty-four feet. The top width is twelve to twenty feet, carrying a cart-road from Shiggaon to the villages on the east. At the north end is a waste channel for the escape of flood waters, and there is a masonry outlet sluice through the dam at each end. The lake is so shallow that on an average the water lasts only for six months after the rains cease, and the lake water has to be supplemented from the wells in the gardens below. These gardens are old established betel and cocoa-palm plantations, and are valuable properties yielding handsome profits to the owners as well as a considerable revenue to Government.

Dambal.

The Dambal lake is fifty-five miles east of Dhárwár in the Gadag sub-division where the rainfall is light and facilities for storing water are few. It is said to be about 300 years old. It was made by an earthen dam 4000 feet long and about twenty-five feet in greatest height whose water face is guarded by a massive dry-stone retaining wall. It has a masonry waste weir at each end, 335 feet long and two masonry outlets for the discharge of water for irrigation. The lake was originally a very fine work, but, at the beginning of the present century, it had greatly silted, and so much of the bed was overgrown with a thick *bábhul* forest that for some time its water had been comparatively useless. A recent survey has fixed the area of water surface at 300 acres and the capacity at $14\frac{3}{4}$ millions of cubic feet. The catchment area measured forty-six square miles, and, with an average rainfall of twenty inches, the supply of water would be greatly in excess of the storage. The lake usually ran dry in December and wells had to be dug and worked for four or five months every year at great cost. The periodical failure of the lake's supply resulted in much of the land lying fallow for half the year, after the six months' crops were reaped, and a great deal was sown with ordinary dry crops. The lake was repaired by Government in 1824 and 1849, and in 1860 minor repairs were carried out. It was further repaired during the famine of 1876-77 and 1877-78. The 1876 and 1877 improvements included the raising of the water surface six feet, thereby increasing the lake's storage capacity from $14\frac{3}{4}$ to 108 millions of cubic feet; the making of a new waste weir 300 feet long with its crest twelve feet below the new top of the dam on which extreme floods are calculated to rise 8.6 feet; the extension and improvement of the outlets; the construction of a distribution channel $1\frac{1}{2}$ miles long commanding 1790 acres; and the clearing of the *bábhul* forest in the lake bed. These great improvements were completed by the end of 1878.

Madag.

Besides these lakes a fourth called Madag lies in Maisur limits about two miles south of the Kod town of Másur. The boundary between Kod and Maisur runs along the top of the old dam so that the lake is in Maisur, while the lands which it waters are in Kod. Like other irrigation works in the south and west of the district, the Madag

lake is believed to date from the time of the Vijayanagar kings (1335-1570). The maker of the lake intended to close the gap in the hills through which the Kumudvati feeder of the Tungbhadra flows into Kod, and by this means to form a lake on the south side of the range of hills which divide the Másur valley from Maisur. This was accomplished by throwing up an earthen embankment, now about 800 feet thick at the base and 100 feet high, faced towards the lake with huge stone blocks descending in regular steps from the crest of the embankment to the water's edge. Two similar embankments were also thrown across other gaps in the hills to the right and left of the Kumudvati valley to prevent the pent-up waters escaping by them, and a channel was cut along the hills for the overflow of the lake when it had risen to the intended height. When full this lake must have been ten to fifteen miles long and must have supplied water for the irrigation of a very large area.¹ The neighbouring hills still bear traces of vast cuttings for material and of the roads by which it was brought to the site. A moderate sized fort on the hill commanding the lake is said to have been built for the protection of the work people. Each of the three embankments was provided with sluices built of huge slabs of hewn stones for the irrigation of the plain below, and two of these remain as perfect as when they were built. These sluices were built on the same principle as other old Hindu local sluices, a rectangular masonry channel through the dam closed with a perforated stone fitted with a wooden stopper. But, as the sluices had to be in proportion to the size of the lake, instead of the small stone pillars which in ordinary works carried the platform over the stopper, the supports were formed of single stones weighing about twenty tons each. To the upper sluice a tradition of human sacrifice attaches. As it was the crowning point of this great work the Vijayanagar king and his court met to see the great single stone pillars raised to their places. For days the workmen's efforts were vain. At last it was known that the Place Spirit was angry, and, unless a maiden was offered to her, would not allow the pillar to be raised. Lakshmi the daughter of the chief Vadar or pond-digger offered herself, and was buried alive under the site of the pillar. The spirit was pleased, and the pillar was raised and set in its place without mishap. In honour of Lakshmi the sluice became a temple.²

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¹ Bom. Gov. Sel. CLX. 87.

² Lieut.-Colonel Playfair, R. E., Superintending Engineer for Irrigation, 27th October 1879. According to a second legend the *pátíl* of Másur, whose family lived at Pura Parkeri in the Maisur division of Shimoga had a beautiful daughter Kenchava whom the Vijayanagar king wished to marry. As her father was of a higher caste than the king the girl refused the king's offer and fled. Afterwards her parents wished to marry Kenchava to the *pátíl* of Isur in the Shikárpur sub-division of Maisur. They set out to celebrate the marriage, but on passing a temple now covered by the waters of the Madag lake, Kenchava entered the temple and devoted herself to the god. When the lake was made, Kenchava refused to leave her god, and, when the first floods of the rainy season came, the temple was hidden under the lake and the girl was drowned. It was a season of severe floods and a watchman was set to watch the dam. Kenchava entered into this watchman and told him to go and tell the *pátíl* that unless he offered her a woman nine months with child she would burst the lake.

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The lake was finished and filled. But in some heavy flood it burst not through the carefully closed valley but by the most westerly of the three embankments. Through this outlet a vast body of water forced its way in a deep groove with a fall of nearly 100 feet, wearing a chasm with nearly perpendicular sides as if cut with a knife. As the pressure of the water grew lighter and the strata to be cut became harder, the wearing ceased, and a certain quantity of water remained in the bed of the lake. The surplus now passes in a pretty little waterfall over the point where the cutting ceased. After this disaster no steps were taken to make use of the water which the broken lake still held. The builders abandoned the undertaking, and, till recent times, the unfinished channels and the dam remained overgrown with forest. It was sometimes visited to see the single stone of the main sluice which remained one of the wonders of the country. After the country passed to the English two difficulties prevented any use being made of the water stored in the broken lake. When the breach occurred, the lowest of the old native sluices, which offered the only channel for drawing water through the enormously thick dam, was left too high above the surface of the water to be of any value. Any attempt to dam the outlet chasm, and so raise the level of the lake sufficiently to use the old sluices, was prevented not only by its great expense, but by the opposition of the Maisur villagers, whose lands lay on the margin of the lake, and would be swamped by any rise in its level. Owing to these difficulties nothing was done until, in 1858-59, Lieutenant-Colonel Playfair, R. E., then executive engineer, thought that if a culvert could be laid below the old sluice the lake could be successfully tapped. This was done under Colonel Playfair's immediate supervision. For this the old native sluice had first to be cleared as it was filled with dirt. Clearing was begun on both sides, not without the opposition of the Maisur people who at first drove the workmen off, and objected to anything being done on their side. When the two parties of workmen came within 100 feet of each other progress was stopped as the stones that supported the roof were found to have fallen in. The sluice appears to have been originally laid on the rocky surface of the valley, roofed with enormous stones, and the dam

The watchman said he could not leave his post. Kenchava promised that if he went she would not break the big dam but that if he was long in coming back she would burst through one of the hills. The watchman went and gave the headman Kenchava's message. But the headman paid no heed to his message, punished him for leaving his post, and offered Kenchava no sacrifice. Enraged with his insolence Kenchava broke through the hill and the embankment as well. Poor people used to go to the lake and beg Kenchava to lend them nose and earrings to use at a wedding and found what they wanted at the water side. One man forgot to return the ornaments and Kenchava no longer provides them. In 1870, a fisherman's tackle got entangled in the roof of the under-water temple. Diving down to free his tackle the fisherman entered the temple and saw a golden image of Kenchava. She warned him to tell no one she was alive, and told him that on the day he let out her secret he would burst a blood-vessel and die. He asked her how he could get out of the temple; she gave him a push and he was on the surface. He kept his secret for two years, told it, burst a blood vessel, and died. In seasons of drought, the heads of the temples in Shikárpur come to this lake with a round piece of gold and a nose-ring. They lay food on a small raft and pushing it into the lake pray Kenchava to send rain. Dr. Burgess' List of Archæological Remains, 17-18.

built over it. The weight of the one hundred feet of earth had been too great for the sluice-roof. In the part where the sluice-roof had fallen the further clearing became a matter of great danger. The only plan appeared to be to gently dig over the broken stones and trust to find sounder ones beyond, and thus again to get a roof over the heads of the workmen. This attempt was successful. Only a few of the covering stones had fallen in; and the earth above them was sufficiently consolidated by time to allow of a passage being dug through it. The two parties at length joined, and the old subterranean gallery was opened through its whole length of 800 feet. The digging of the culvert below the floor of the old sluice was then begun, the old work acting as a ventilator as well as a roof till the new tunnel was arched. All went well till towards the centre where a mass of extremely hard rock gave much trouble.

As a part of Colonel Playfair's scheme two canals were to be dug, leading off $33\frac{1}{2}$ feet above the original bed of the river. Six miles of the whole length of the $16\frac{1}{2}$ miles of the left bank canal, and eight miles of the whole length of the $15\frac{1}{2}$ miles of the right bank canal have been dug. The left bank canal is carried along the rear slope of the main embankment until it reaches the new river channel which it crosses by a large aqueduct. In 1882-83 four miles of the right bank canal were planted with about 7200 trees mostly *bábhuls*, mangoes, and *nims*. The total area watered was 482 acres and the crops watered were mostly sugarcane, rice, garlic, and onions. The water rates vary from 16s. (Rs. 8) an acre for twelve months' crops to 2s. (Re. 1) an acre for rainy-season crops. The lake might easily be made to hold a great deal more water. Even by boarding the waste weir the storage might be greatly increased. What prevents the carrying out of fresh works is that every foot which the surface of the lake is raised swamps a large area of rich land. In 1872 an attempt was made to induce the Maisur villagers to accept compensation and let the land be flooded; but the attempt failed. The matter is still under consideration, and it is hoped that some arrangement may shortly be made. At present as the canals are small, with only a slight fall, it is not possible to draw off the lower portion of the water above the sluice sill level, and the upper portion is lost by evaporation. As the total depth of the lake above the sill of the canal sluices is only 4.50 feet little water is available for late and hot weather crops. The ordinary rainfall is enough for the common early crops which are grown to a great extent in the neighbourhood.

The only important system of canal irrigation is on the south bank of the Dharma, the Varda's chief feeder, which rises in the Sahyádrí hills about twenty miles south-west of Hángal. The work is about three hundred years old, but most of the masonry is stones taken from Jain or Chálukyan temples. The head works of the main canal are at the village of Shringeri about five miles south-west of Hángal. A solid masonry weir thrown across the stream raises the water a few feet, and two canals are led off one on each bank. The left bank canal which is called the Kamanhalli canal is about three miles long. It feeds four reservoirs and waters a small area of land on its way. The right bank canal, which is known as

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the main Dharma canal, is seventeen miles long, passing through the villages of Sevhalli, Gejihalli, and Gavrápur. Near its head it sometimes carries over 400 cubic feet the second. At Gavrápur it crosses a road under a masonry bridge and continues through the land of Sirmápur and fills the two large reservoirs of Dholeshtar and Surlishtvar. At Surlishtvar, seven miles from Shringeri, the canal divides into two branches, one flowing east to A'dur and the other flowing south to A'lur. Each of these two main branches throws out a number of smaller channels which command a considerable tract of country between the Dharma and the Varda. The Dharma is also dammed by a masonry weir at a point about thirteen miles below Shringeri and a canal known as the Naregal canal is taken off at the right bank. This supplies three ponds at Naregal besides watering the land under its immediate command. The Dharma has a catchment area of sixty square miles at the site of the main canal headworks which is densely covered with forest. This forest land adds greatly to the value of the Dharma as it gives off the rainfall in manageable quantities and over lengthened periods. The Naregal canal intercepts the drainage from a great deal of the land watered by the main Dharma canal as well as the supply afforded by the catchment area of the river between the two head works. The Dharma flows only during the six wet months. To make use of its water during the dry months, a number of ponds were built by the original projectors of the scheme. These ponds are below the canals, and are filled by the surplus water of the river during the rains. Storage is thus obtained during the hot months and irrigation is perennial. In 1881-82 these canals supplied ninety-two ponds of which thirty-nine were fed from the main canal, fifty from the branch canals, and three from the Naregal canal. The largest of these ponds are at Dholeshtar, Surlishtvar, Arleshtar, A'dur, Havanji, Balambid, A'lur, and Naregal. In 1881-82 the area watered by the canal and the ponds dependent on the canal was 8660 acres. Of these 8660 acres 208 were watered by the Kamanhalli or left bank canal, 7399 by the main and branch Dharma canals, and 1053 by the Naregal canal. Of the 8660 acres 8127 were rice land and 533 were garden land. The gardens under the Naregal reservoir are very rich, yielding the finest betelnuts in the neighbourhood. The revenue realized was £3542 (Rs. 35,420). The principles of the original project are sound, but mistakes of detail interfere with the success of the scheme. The fall of the canal bed is unduly slight and is irregular. Nowhere is the fall more than one foot in a mile and in many parts it is much less than a foot. The course of the canal is very roughly laid out. Sharp turns and corners are common, and there are long needless bends, unless indeed owners refused to let the canal pass through their lands. From Shringeri to Surlishtvar not a work was made to carry the local drainage across the canal. In consequence silt deposits are unusually heavy, and nearly the whole of the water which reaches Surlishtvar is carried through the A'lur branch which has a rapid fall. Only in heavy floods, perhaps for a few days twice a year, does the water find its way down the A'dur branch. Formerly all

villagers interested in the canal busied themselves once a year in a general and thorough silt clearing. This custom has gradually fallen into disuse. Where the system is so large and complex the principle of leaving the distribution of the water entirely to the people is open to grave objection. The villages on the higher reaches of the canal take an undue share of the water to the serious injury of those lower down. For some time inquiries have been made how far the whole work can be placed on a sounder footing, and a regular and just system of water distribution be introduced. The attention of the irrigation department has for some time been given to the improvement of the Dharma canal. A survey has been made of the main canal, and it is proposed to carry out works for its improvement and to bring it under proper control. The chief works would be regulating the fall by clearing obstructions, straightening the course in places, providing masonry escapes, and making the width more uniform. It is proposed to fix a regulator at the head-works, to provide proper outlets, and to introduce more system into the management of the canal.

Besides the Dharma canals there are two minor works of the same character; one for using the water of a stream running from the Nidsingi reservoir south to the Dharma at Kuntanhoshalli, and the other for using the water flowing through the valley south of Konankeri, and, by means of a channel made to connect numerous ponds, eventually to carry on the surplus water to the large Belgal reservoir. As regards the first or Nidsingi work, the stream passing near Bassápur was diverted to the Kurgudri reservoir by an embankment and deep cutting south of Bassápur. The original stream passes south and joins the Dharma at Kuntanhoshalli. Between the villages of Kurgudri and Satinhalli an ancient masonry weir across this stream feeds a small channel on the right bank, which waters the lands of Kuntanhoshalli. A mile below this weir stood an old dam from which the Sávasgi lands were watered. This old dam was breached and ruined about forty years ago and the Sávasgi lands lost this supply of water. To provide a remedy it was found more economical to rearrange the Kuntanhoshalli weir work so as to take off an irrigation channel from that weir on the left bank to the Sávasgi lands, than to reconstruct the Sávasgi weir itself. The work is now completed. The supply of water to the Kuntanhoshalli lands has also been improved by the new works. The Belgal Kálva as the channel is called which carries off the surplus water which gathered in a large valley south of Konankeri, connects a number of ponds from which, as each pond gets filled, the surplus water flows into the next, until it ends in the Belgal reservoir. This channel, which is about nine miles long, passes through the lands of Hankanhalli, Bamanhalli, Nellibid, Yelvatti, Talkerikop, and Gundur, and finishes at the Belgal reservoir. In many places are masonry outlets, whence rice lands lying between and not under the lakes are also watered. These outlets are said to have been an after-thought. The villagers of Belgal, who are the last to benefit by this channel, complain that in consequence of these outlets the water is taken for so many fields that the reservoirs do not fill as they used to, and the Belgal

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reservoir has lost a large supply of water. This channel was repaired and the new outlets made some years ago at the expense of the villagers.

According to the Collector's return for 1882-83 of 12,002 wells 3099 were step wells and 8903 were stepless wells. The average depth of a well varies from fifteen feet in Kod to a hundred and twenty feet in Navalgund. The cost of building a step well varies from £30 to £200 (Rs. 300-2000) and of building a stepless well from £7 10s. to £30 (Rs. 75-300). The following table shows the number of wells, their average depth, and the cost of building them:

Dhārwar Wells, 1882-83.

SUB-DIVISION.	WELLS.				COST.			
	With Steps.		Without Steps.		With Steps.		Without Steps.	
	Num-ber.	Aver-age depth.	Num-ber.	Aver-age depth.	Low-est.	High-est.	Low-est.	High-est.
		Feet.		Feet.	£	£	£	£
Dhārwar ...	210	25	1861	70	50	150	10	20
Hubli ...	143	63	1194	80	50	200	15	25
Navalgund ...	24	120	311	120	80	200	20	30
Gadag ...	489	40	824	40	50	100	10	20
Bankapur ...	457	25	663	50	50	100	10	20
Rānebenmur ...	503	40	440	50	50	100	10	20
Hāngal ...	80	30	1339	30	40	80	10	20
Karajgi ...	396	36	573	42	50	100	10	20
Kalghatgi ...	74	44	285	69	50	100	10	20
Kod ...	660	15	1679	15	30	70	7½	15
Ron ...	63	41	234	50	50	100	10	20

Navalgund and Ron which are badly placed for pond storage are also ill-suited for wells. The people are put to much inconvenience, not only because drinking water is scarce, but because it is bad, being charged with salt and lime. The supply of water in wells depends on reservoirs lying on a higher level from which the water soaks into the wells below. The wells in garden lands are nothing more than ponds of all sizes and shapes, and as they are not regularly built or surrounded with a parapet wall, the rains sweep much mud and filth into them, and unless they are regularly cleared they become choked and useless in a few years. These wells begin to be used about March, when, either from a scanty rainfall or from other causes, the pond supply begins to fail. When the water in the wells is on a level with or near the surface, two men scoop up the water by swinging a basket or *guda* through it. When the water is five or six feet below the surface the leather bag or *mot* is worked. As many of these wells are shallow and have no spring they dry as soon as the ponds.

MANURE.

The use of manure is generally understood. Except alluvial lands, all fields are more or less manured according to their wants. The garden lands are fully manured especially those growing the richer crops, which are manured with great care and with as much liberality as the husbandman can afford. Rice lands are freely manured and even the dry crops get a fair share. Waste lands, when brought under tillage, are not manured for the first year or two. In such cases the first crop sown is almost always Indian millet followed by

a green or oilseed crop. If it seems to want it the land is manured before the third crop is grown. Black and good brown soils are manured once in three, four, or five years. They are naturally rich, and their vigour is renewed by the upper soil being always washed into cracks and the subsoil coming up for tillage. Red and poor brown soils are manured every second year and in some cases, if the husbandmen can afford it, every year. Sugarcane, rice, Indian millet, chillies, and *rāgi* want manure every year; *sāve* Panicum miliare, castor-oil, and *uddu* Phaseolus mungo want manure once in three years. On account of the labour and cost of carting the manure, fields more than a mile from the village are not manured oftener than once in three or four years. There are four methods of enriching the soil, the chief of which is mixed manure. This consists of cattle droppings, ashes, stubble, the shells of betelnuts, urine, and every form of rubbish which can be gathered. All this is stored in a pit near or in the husbandman's yard. The manure in the pit is occasionally covered by a thin layer of earth or house sweepings by which the volatile properties are kept from passing into the air. Some time before sowing, the manure is carted to the fields, piled in small heaps, spread on the field, and ploughed into the soil. In sowing Indian millet and other grains the poorer husbandmen mix the manure with the seed. As each husbandman has his manure pit, manure is not sold. An acre of garden land wants ten cartloads of manure of the nominal value of 5s. (Rs. 2½), and an acre of rice or dry-crop land wants four cartloads nominally worth 2s. (Re. 1). The second way of manuring is by having the stubble, the cotton leaves, and the weeds eaten by sheep or goats. These animals are known to leave their droppings on the ground the moment their rest is disturbed. The husbandmen contract with the shepherd that the sheep or goats shall not be allowed to rest more than an hour or two in one place, but be moved from time to time in the field. The urine and droppings are thus evenly spread over the whole field. When the finer-grained crops such as *sāve* Panicum miliare, and *yellu* Sesamum indicum are about to be sown the stubble is gathered in heaps and burnt on the field. The fourth way of enriching the soil is by green manuring. Black sesamum or *guryellu* is sown in late May or early June and is allowed to grow for three months when it flowers. It is then ploughed in and destroyed by the heavy hoe or *kunti*. This is considered sufficient manure for two years. In some places pond silt is spread on the fields, but silt is not so enriching as the other manures.

A two years' change of crop is held to be relief enough to the soil. In black soils cotton and Indian millet, as a rule, are sown alternately. In red soils Indian millet is followed by Italian millet, *rāgi*, *sāve*, chillies, or castor-oil, that is the change is from grain to green crops or from grain to oil-seeds. Oil-seeds are often used as a relief to the usual change of grain and green crops. The same crop is seldom sown in the same land for two successive years. The chief exception to this rule is that grain may be sown in the same field for several years without a change if care is taken that a late crop succeeds an early crop. Thus the early millet may be succeeded

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by the late *navani* *Panicum italicum* or wheat. Green and oil crop may also be grown for several years in succession if the crop is changed, thus gram and safflower may come after cotton or black sesamum. As these are all late crops the soil has the benefit of a whole year during which it rests through the hot season and the early rains to receive which it is turned more or less deeply. With an average supply of rain good black soil yields a second crop. In the plain to get a second crop the early crop must be white sesamum. This is reaped in the end of August, when the soil is thoroughly ploughed or otherwise turned, and wheat or gram with an occasional row of safflower, linseed, or castor-oil are sown. After these the next crop is generally one of the early millets for which the soil is manured. There are therefore three modes of changing the crop : A change of grain with green crops or oil plants, a change of oil plants with green crops, and a change of early with late crops.

FIELD TOOLS.

Dhárwár field tools are like those used in the neighbouring districts of Belgaum and Bijápúr. A detailed description is given in the Belgaum Statistical Account. The chief field tools are the heavy plough or *negali* (K.), the light plough or *ranti* (K.), the large hoe or *kunti* (K.), the leveller or *korudu* (K.), the seed drill or *kurgi* (K.), the grubber or *yadi kunti* (K.), and the pickaxe or *báigudli* (K.). Both the heavy or *negali* (K.) plough and the light or *ranti* (K.) plough consist of a thick log of wood shaped by the village carpenter, with its lower end curving forward at an obtuse angle from the main block. The share, which is an iron blade, one and a half feet long by three to four inches broad and four to twelve pounds in weight, is let into a socket and fixed by a movable iron ring to the wooden point beyond which it juts about six inches. The handle is fixed to the block by a thick rope passed along the beam and tied to the yoke, so that the strain of draught braces the different parts of the plough. The *negali* is a large, heavy, deep-cutting plough, and is worked by two to six pairs of bullocks. Besides the ploughman, who is seldom able to keep the plough in anything like a straight line, it requires one to two men to drive the team. It costs £1 4s. to £1 12s. (Rs. 12-16) and as a rule is owned only by wealthy landholders who often lend it to their poorer neighbours. Except when the land is in very bad order the *negali* is never used. It is very effective in loosening stiff land and in uprooting weeds. The *ranti* (K.) or light plough is of exactly the same make as the heavy plough. The only piece of iron about it is a narrow bar about nine inches long which serves the purpose of a share. It is worked by one pair of bullocks and costs about 4s. (Rs. 2). The ploughman manages it by himself as the reins of the bullocks come to the handle of the plough. In red and black soils the small plough is used before sowing to turn the soil ; but, except cotton fields, good black soil often yields for several years without wanting even the small plough. The large hoe or *kunti* (K.) is a rude tool. The chief part is a stout slightly crescent-shaped blade of iron about three feet long and four to five inches broad, fastened in stout timbers with its cutting edge turned forward. The timbers are secured slopingly in a heavy beam of wood five feet long and one foot broad. The beam is joined to the yoke by two lighter pieces of wood and

from the upper surface of the beam rises the handle to which one end of a rope is tied and the rope is wound once round the lighter timbers in the middle, and is taken to the yoke and tied there. The large hoe costs about 10s. (Rs. 5) and is worked by four bullocks. To add weight a couple of boys generally sit on the beam, on each side of the handle, and are ready to clear stones stubble and other rubbish that may choke the hoe. Except in rice lands, in all lands where a plough is used before sowing, the large hoe or *kunti* follows the plough, breaks the larger clods, gathers the roots of weeds and of the last crop, and thoroughly loosens the soil. In rich black soil, where for several years no ploughing is required before sowing, the large hoe is used to turn the soil. As land stiff and full of weeds requires the *negali* or heavy plough, so weedy stiff land requires a larger deep-cutting hoe called *mági kunti* (K.). A third small light hoe called *ballesal kunti*, is, in all soils, used after the *kunti* to level the surface and to cover seed sown by the seed-drill or *kurgi*. Besides the different hoes, a log called the *korudo* or leveller is used for breaking clods and smoothing the surface. The leveller is the log of a tree trunk split down the middle, scooped out and smoothed outside, and with two wooden pieces driven through it, on which the drag ropes and yoke are tied. When at work the driver stands on the leveller to give it weight. The seed-drill or *kurgi* is of two kinds, one for sowing grain and the other for sowing cotton. It consists of wooden beam with three to four wooden bills standing out at equal distances and armed with small iron tongues to make drills. To each of these bills is fixed a bamboo tube whose upper end is joined to a hole in the bottom of a wooden cup which has as many diverging holes as there are tubes. It costs about 4s. (Rs. 2) and is worked by a pair of bullocks yoked in the same manner as in the light plough or the light hoe. The driver fills the cup with seed. In some villages the seed-drill has only three bills, which are wider apart than the four bills. When mixed grains are to be sown in one of the drills the driver plugs the cup hole for that drill and the seed is sown by a man who walks behind, and, from a clothful tied at his waist, drops seeds through a hollow bamboo called *bukku* which is tied to the seed-drill. The cotton seed drill is made on the same plan as the grain-sowing *kurgi*. It has only two bills eighteen inches apart and has no cups with holes. It is worked by a pair of bullocks yoked in the same way as in the grain drill. At the back of the beam of the seed-drill are tied by ropes two hollow bamboos or *bukkus*, which are kept in furrows drilled by the iron tongues of the bills, by two sowers, who from a clothful of seed at their waist drop the seed through them. The grubber or *yadi kunti* is used to clear grass and weeds between the rows of young crops. It also earths up the soil at the roots of young cotton plants. It consists of a beam two and a quarter feet long by six inches broad with two stays like the harrow. In the lower end of each stay a blade of iron is fixed horizontally to the beam. Two beams are generally worked by one pair of bullocks; and sometimes one pair of bullocks works three and in rare cases even four beams. Each beam is joined to the yoke by two stout bamboos, each fixed to the beam over each stay, and is guided by one man. It costs

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2s. 6d. (Rs. 1¼). The pickaxe or *báigudli* has one end pointed and the other end bladed into a sharp adze. It is most effective in cutting and uprooting grass and other weeds after the land has been ploughed. It costs about 10½d. (7 as.). Besides these field tools there are a weeding hook or *kurchegi* worth about 9d. (6 as.), an axe or *kudli* worth 2s. (Re. 1), a sickle or *kudgolú* worth about 2s. (Re. 1), a saw-sickle also called *kudgolú* worth 1s. to 2s. (Re. ½-1), and a spade or *sulki* worth about 2s. (Re. 1). Two carts are used for field purposes. The crop cart for bringing home field produce or carrying produce to market is about twelve feet long and three to four feet broad. The floor is made of two strong bars joined by four or more cross pieces at equal intervals. The wheels are of solid timber each of two or three pieces joined together and surrounded by a heavy iron tire two inches thick and nearly two inches broad. The wheels gradually thicken from the rim to the nave. The axle tree, which is an iron cylinder, being considerably below the height of the bullocks, the floor is raised by a tongue resting on the axle. By this means, if the load is well balanced on the cart, the bullocks have comparatively little of the weight, and the draught, being on a level with their shoulders, is easier. From the axle run two poles to the ends of which the yoke is tied. With outriggers on both sides, the cart can carry a very great weight. It is rudely shaped and heavy; even when empty it is a hard pull for one pair of bullocks; when loaded it requires four to six yoke of oxen. It costs £4 to £16 (Rs. 40-160). The manure cart differs from the crop-cart in having high sides made of *tur* stalks or bamboo matting. By removing the sides the manure cart is sometimes used for other purposes. They are drawn by two to three pairs of bullocks.

TILLAGE.

Except a few black soil fields owned by traders and money-lenders which are covered with grass and bushes, because they are let to men who have neither the means nor the heart to work them, tillage is carried on with care and labour. Except when they are thickly covered with *hariáli* (M.), *nat* (K.), or *karige* (K.) grass, *Cynodon dactylon*, or, when the intended crop is cotton, black soils do not require a yearly ploughing. Ploughing instead of improving harms Indian millet, for if the fall of rain is heavy the black soil runs together and becomes too wet for the proper growth of the young plants. This does not happen when the surface is simply loosened by the large hoe or *kunti*. Red soils require more tillage. The field should be ploughed twice, once lengthwise and once crosswise. When moist, red soils become light, friable, and easily worked. Two bullocks only are required to draw the plough, and the labour and expense are not much more than in hoeing black soil. Besides ploughing it is always necessary to use the large hoe once or twice to all kinds of soils before sowing, and, in the early stages of their growth, both Indian millet and cotton must be frequently hoed and cleaned. Cotton requires particular care. If grass and weeds are not constantly rooted out the young plants are stunted and the outturn is small.

SEASONS.

Dhárwár shares both in the south-west and in the north-east or Madras rains in a greater degree than any other district in the

Presidency. The south-west rains are most felt in the hilly and woody west, the north-east rains in the open east and north, and both about equally in the two southern sub-divisions of Kod and Ránebennur. The prevailing tillage in the west is wet chiefly of early or *mungári* crops; in the east the tillage is dry chiefly of late or *hingári* crops. In Kod and part of Ránebennur, which share in both rains and have both dry and wet tillage, entire failure of crops from drought is unknown, though it often happens that the rainfall favours one kind of tillage more than another. No rainfall can well be too heavy for rice when once it is well above ground; while too much rain harms dry-crop tillage. On the other hand the rainfall which is most suitable for dry-crop tillage is not all that can be desired for rice. The husbandman's year of 365 days is divided into twenty-seven lunar asterisms or star-chambers. These are *Ashvini* of fourteen days from the 11th to the 24th of April; *Bharni* of fourteen days from the 25th of April to the 8th of May; *Kṛitika* of fifteen days from the 9th of May to the 22nd of May; *Rohini* of thirteen days from the 23rd of May to the fourth of June; *Mrigshirshé* of fifteen days from the 5th to the 19th of June; *A'rđi* of fourteen days from the 20th of June to the 3rd of July; *Punarvasu* of fourteen days from the 4th to the 17th of July; *Pushya* of fourteen days from the 18th to the 31st of July; *A'shlesha* of fourteen days from the 1st to the 14th of August; *Maghe* of thirteen days from the 15th to the 27th of August; *Hubbe* of fourteen days from the 28th of August to the 10th of September; *Uttara* of fourteen days from the 11th to the 24th of September; *Hastu* of thirteen days from the 25th of September to the 7th of October; *Chette* of fourteen days from the 8th to the 21st of October; *Svāti* of thirteen days from the 22nd of October to the 3rd of November; *Vishákhe* of thirteen days from the 4th to the 16th of November; *A'nurádhi* of thirteen days from the 17th to the 29th of November; *Jeshtha* of thirteen days from the 30th of November to the 12th of December; *Mul* of fourteen days from the 13th to the 26th of December; *Purváshádha* of thirteen days from the 27th of December to the 8th of January; *Uttráshádha* of thirteen days from the 9th to the 21st of January; *Shrávana* of thirteen days from the 22nd of January to the 3rd of February; *Dhanishte* of thirteen days from the 4th to the 16th of February; *Shutatare* of thirteen days from the 17th of February to the first of March; *Purvábhádre* of fourteen days from the 2nd to the 15th of March; *Uttrábhádre* of twelve days from the 16th to the 27th of March; and *Revati* of thirteen days from the 28th of March to the 10th of April. Seven of these between *Kṛitika* and *A'shlesha*, that is between the 9th of May and the 14th of August, form the early or *mungári* season; six between *Maghe* and *Svāti*, that is between the 15th of August and the 3rd of November, form the late or *hingári* season; eleven between *Hastu* and *Shrávana*, that is between the 25th of September and the 3rd of February, form the harvesting season; and seven between *Uttráshádha* and *Revati* that is between the 9th of January and the 10th of April form the cotton-picking season.

The normal Dhárwár rainfall may be divided into three periods. The first lasts from the middle of April to the end of the first week

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in June. Every ten or fifteen days in these six weeks should have a heavy easterly thunderstorm with half an inch to two inches of rain. These falls are wanted for the western rice lands that the rice may be sown before the end of May. East of Hubli these showers have no special use as the black soil grows no rice, and no crops are sown before the end of June or the beginning of July. The next period is the south-west monsoon, which lasts from the middle of June till the middle or end of September. The monsoon should begin with about a week of heavy showers lasting some hours every day to soak all land intended for early *javari* or *ragi*. After a week's rain should come a nearly fair week that field work may be pressed on. The first sowings of *javari* should take place in early July. The whole of July should be wet, with few entirely dry days. August is generally a dry month, with as a rule not more than two to three inches of rain. These August showers moisten the surface of the eastern plain and prepare it for the sowing of late or white *javari* and cotton. The date of sowing white millet and cotton varies with the rainfall from the middle of August to the middle or even the end of September. Wheat mixed with linseed or safflower is sown still later. September should be moderately wet with many fine days. The harvest depends on October more than on any other month. October is also the month of most uncertain rainfall. If no rain falls in October, as was the case in 1876, the cotton, the late *javari*, and the wheat are entirely lost. If unusually heavy rain falls in October, as fell in October 1877, the early *javari* ears sprout. The whole of the October rainfall is from the east. It is not steady rain, but comes in sudden and heavy downpours which last an hour or two. The whole October rainfall should be about six inches, half an inch to two inches falling in one heavy plump every few days. This gives all the moisture which the cotton, wheat, and later *javari* require. After October the less rain that falls the better both for harvesting the early *javari* crop and for the health of the growing cotton wheat and other late crops. December and January seldom pass without a few days often of heavy rain. In the east heavy December and January rain mildews the wheat; in the west heavy December and January rain does little harm as the rice and early *javari* are harvested in November and early December.¹

CROPS.

In 1881-82 of 1,507,942 acres the whole area held for tillage, 184,776 acres or 12·25 per cent were fallow or under grass. Of the remaining 1,323,166 acres, 1661 were twice cropped. Of the 1,324,827 acres under tillage, grain crops occupied 756,034 acres or 57·06 per cent of which 389,411 were under Indian millet *jola* (K.) or *javari* (M.) Sorghum vulgare, 174,827 under wheat *godhi* (K.) or *ghani* (M.) Triticum aestivum, 85,117 under rice *bhatta* (K.) or *bhat* (M.) Oryza sativa, 47,830 under *navani* (K.) or *kang* (M.) Panicum italicum, 28,859 under *ragi* (K.) or *nachni* (M.) Eleusine corocana, 17,911 under *save* (K.) or *vari* (M.) Panicum miliare, 4099 under spiked millet *sejje* (K.) or *bagri* (M.) Penicillaria spicata, one under

¹ Mr. F. L. Charles, C.S., in the Famine Commission Report, 14-15.

maize *mekke jola* (K.) or *makai* (M.) *Zea mays*, and 7977 under other grains of which details are not given. Pulses occupied 101,197 acres or 7·63 per cent, of which 33,035 were under gram *kadli* (K.) or *haròhara* (M.) *Cicer arietinum*, 25,575 under *togari* or *tuvari* (K.) or *tur* (M.) *Cajanus indicus*, 24,200 under *hurli* (K.) or *kulthi* (M.) *Dolichos biflorus*, 14,760 under *hesaru* (K.) or *mug* (M.) *Phaseolus radiatus*, 426 under *uddu* (K.) or *udid* (M.) *Phaseolus mungo*, and 3201 under other pulses. Oilseeds occupied 70,426 acres or 5·31 per cent, of which 14,734 were under linseed *agashi* (K.) or *javas* (M.) *Linum usitatissimum*, 3694 under sesamum *yellu* (K.) or *til* (M.) *Sesamum indicum*, 41 under Indian mustard *sásive* (K.) or *rái* (M.) *Sinapis dichotoma*, and 48,957 under other oilseeds. Fibres occupied 359,210 acres or 27·11 per cent, of which 357,701 were under cotton *hatti* or *arale* (K.) or *kápus* (M.) *Gossypium herbaceum*, 1222 under Bombay hemp *sanbu* (K.) or *tág* (M.) *Crotalaria juncea*, and 287 under Indian hemp *pundi* (K.) or *ambádi* (M.) *Hibiscus cannabinus*. Miscellaneous crops occupied 37,960 acres or 2·86 per cent, of which 28,748 were under chillies *menasinakai* (K.) or *mirchi* (M.) *Capsicum frutescens*, 3742 under sugarcane *kabbu* (K.) or *us* (M.) *Saccharum officinarum*, 1251 under tobacco *háge soppu* (K.) or *tambáku* (M.) *Nicotiana tabacum*, seven under ginger *shunti* (K.) *alla* (M.) *Zinziber officinale*, and the remaining 4212 under various vegetables and fruits.

The following are the details of some of the most important crops: Indian Millet, *jola* (K.) *jvári* (M.) *Sorghum vulgare*, with in 1881-82, 389,411 acres or 29·39 per cent of the tillage area, is the most widely grown crop in the district, the grain forming the husbandman's chief food and the straw supplying the best cattle fodder. In good black soil free from weeds for Indian millet the land is treated in the same way as for cotton. Red soils must be manured and ploughed before the leveller or *korudu* is used. No fewer than eighteen varieties of Indian millet are grown in Dhárwár. Of these two *bili jola* (K.) and *kari-goni jola* (K.), the finest of the whole are late or *hingári* crops. The remaining sixteen are *mungári* or early varieties. Of the sixteen early varieties six, *murtinjola*, *dhodajola*, *utal-phulgara*, *chejkara*, *kagi-jola* and *nandihál* are sown as regular crops, never as occasional rows among other crops; a seventh variety *bhagvant phulgara* is sown both as a single crop and in rows among another crop. All of these seven mature in three to four months. The seven other varieties *patansáli*, *garri kulu* or *kulmudumugu*, *lasvanpadu*, *phulgara*, *jelkanjola* or *jogi-jedi-jola*, *ken-jola*, and *kodmukanjola* are, except *kodmukanjola*, sometimes sown as regular crops but usually as occasional rows in fields of *navani* *Panicum italicum* or *rági* *Eleusine corocana*. *Jelkanjola* does so well as an occasional row crop that it has the special name of *ukkudi jola*, *ukkudi* meaning an occasional row. When sown with late crops all of these seven are intended only to supply cattle with green fodder. The two remaining varieties *halmukan-jola* and *ulkanjola* are mixed with some of the above varieties before they are sown. These two may be eaten roasted; they are never made into bread. The early or *mungári* kinds are sown in July and August, and are reaped from October to

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December. Along with the early Indian millet generally in every fourth row or drill, are sown cajan pea *hurli* or *Dolichos biflorus* and *mataki* or *Phaseolus aconitifolius* which thrive with the same preparation of soil as the millets. The late or *hingári* Indian millets are sown in October, and reaped in February and March. With them are sown occasional rows of safflower gram and linseed. Unless the ground is well manured Indian millet is not sown in the same field for two successive years; the second crop is either cotton, wheat, gram, or safflower.

Rági.

RA'GI (K.) or *náchni* (M.) *Eleusine corocana*, with 28,859 acres or 2·17 per cent of the tillage area, is grown both in red and black soils, but generally in the red soils of the hilly west. Of two kinds of *rági* both are sown in June after the first burst of the south-west monsoon, and reaped one kind in October and the other in December. In preparing red soil for *rági* the ground is ploughed with the large plough and is afterwards broken and levelled. Manure, at the rate of one or two cart-loads an acre, is laid in heaps at equal distances, and the seed is thoroughly mixed in the manure. Furrows are cut with the small plough, the sower following the plough with a basket full of mixed manure and seed which he drops in the furrow, his basket being kept full by a man who walks to and from the heap. When the sowing is over the leveller or *korudu* breaks the clods and covers the seed, the light hoe or *ballesal kunti* is passed over the surface, and is once more followed by the leveller. Along with *rági* a little mustard and the variety of Indian millet known as *ukkadi-jola* are sometimes sown. At intervals a row of cajan pea is drilled in. Thirty five years ago (1848) when wood-ash or *kumri* tillage prevailed, *rági* and *sáve* were planted in forest clearings. In these clearings no manure but the ashes of cut underwood were used. The same clearing only yielded a crop two years in succession when the ground was left fallow till the underwood had grown high enough to be again burnt.

Sáve.

SA'VE (K.) or *vari* (M.) *Panicum miliare* with 17,911 acres or 1·35 per cent of the tillage area, is grown in the same way as *rági*. Of two varieties, one, *muligi sáve* is sown in June after the first burst of the south-west monsoon, and reaped in September; the other is sown from the 1st to the 15th of September and reaped in late December. *Muligi sáve* or early panic is seldom grown in the western forest villages, because, as it ripens before any other grain it has to bear the whole attacks of the wild hogs which infest those parts, and it is not valuable enough to make it worth watching.

Wheat.

WHEAT *godhi* (K.) or *ghau* (M.) *Triticum aestivum*, with in 1881-82 174,829 acres or 15·19 per cent of the tillage area, is grown chiefly in Navalgund, Gadag, Hubli, Ron, and Dhárwár. It does not thrive well in Bankápur. The three chief varieties of wheat are the red or *támbda*, the local or *jvári* apparently meaning Karnátak, and the *deshi* also local apparently meaning Deccan. Of these the red is the finest and is much like English wheat. Wheat is the last sown of the cold weather crops. It is not sown till the October rains are over, and there is no chance of more rain. Wheat is generally grown in good soft black soil which has been thoroughly broken by the large plough followed by

the heavy hoe or *kunti* and the light hoe or *ballesal kunti*. Twenty-four to forty pounds of seed an acre are sown through the seed drill and the soil is again worked with the light hoe. After this it wants no weeding or other care. Wheat is grown every third year, and is followed by Indian millet. In some places wheat alternates with sugarcane and gram and occasionally safflower is raised between the rows of wheat two to six feet apart. Safflower does not ripen till a month after the wheat and does not interfere with its growth. The wheat crop takes three to three and a half months to ripen. Towards the end of December it should have one good shower. When the seedlings are about a month old they are apt to suffer from rain or dew, and from a disease called *bhandar* which is caused by westerly winds. Southerly winds are also unwholesome. Excessively cold breezes bring on a disease called *ittangi* (K.) which makes the wheat plants turn reddish and bear poor or no ears. The acre outturn is said to vary from 60 to 300 pounds and to average about 200 pounds. The average wholesale rupee price of wheat is about thirty pounds. Wheat is not the staple food of the people of the district. It is used only by the rich and the well-to-do. In the south of the district a little wheat is brought from Kumta in North Kánara. Of the local wheat some is sent to Belgaum. At present (1884) the cost of carriage to Belári, the nearest railway station, is about £2 8s. (Rs. 24) the ton.

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Wheat.

RICE *bhatta* (K.) or *bhát* (M.) *Oryza sativa*, with 85,117 acres or 6·42 per cent of the tillage area, is grown almost wholly in the woody west which is locally called *malládu* or hill land. Rice wants much and constant moisture. When it depends on rainfall alone rice is always uncertain, but this element of chance rather fascinates the people. Most rice land is independent of simple rainfall for its water-supply. The lowlying lands are watered from ponds and much is also watered by drainage from neighbouring high grounds guided by water-courses or *kalvās*. Failing pond water irrigation is supplied from wells or more commonly from holes fed by underground soakage from ponds. The rice soil is red towards the extreme west, and further east it is a light coloured clayey mould. This clayey soil, by the action of water, tillage, and weather, becomes stiff, compact, and very retentive of moisture. This kind of rice soil is poor, middling, or good according to its situation. In high and exposed sites it is poor and shallow, even with care and manure able to bear only one crop of poor rice; in middle situations neither very high nor very low it is middling, of some depth, and where there is moisture enough, yields two crops, one of rice and the other of pulse; in low lands or valleys it is of superior richness, of a rich dark brown, and yields excellent after-crops. Regular rice fields are divided into level compartments a few feet to fifteen or twenty yards broad and varying in length according to the landholder's pleasure or the position of the ground. The slope of the ground or hill side is generally carried into a series of terraces each one or two feet higher than the one immediately below it, and the front of each is guarded or raised by a foot high embankment forming part of the descending step. The effect of a hill or rising ground terraced in rice plots is extremely pleasing. The three kinds of rice-land require almost the same labour. After harvest the poor soil seldom holds

Rice.

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Rice.

moisture enough to allow of its being ploughed; middle class soil even when not moist enough to yield an after-crop, is always damp enough to be ploughed, and the ploughing is a gain as it makes the land more ready to receive the occasional dry-season showers. The upturned grass and stubble roots die and rot, and the stiff clods crumble in the heat and air. At the end of March manure is laid in heaps. In early April the clods are broken by the leveller or *korudu*, or, if still very hard, by labourers with clubs. In fields which have not been ploughed after harvest nothing, except the laying of manure, can be done till the first rains of late April or May, when the field is ploughed and the clods are broken by the mallet. The manure is then scattered broadcast from a basket, the surface is turned by the heavy hoe or *kunti* and the leveller or *korudu* follows. Nothing further is done till rain enough falls to admit of sowing for which a small seed-drill or *kurgi* is generally used. An acre of rice land on an average wants three to five loads of manure. If more is laid on, and the rains are abundant the crop will gain greatly; but with light rain in highly manured land the crop will grow too freely and will probably dry without coming to ear. From the 25th of May to the end of June, as soon as the village astrologer has fixed the lucky day, the seed drill is decked with green leaves, the husbandman bows before it, and sowing begins. The drill is closely followed by the *balle-sal-kunti* or light hoe to cover the seed, and the *korudu* follows to level the surface. In about eight days the seed sprouts, and in eight days more weeding begins with the *yadi kunti* or grubber and is repeated generally once in ten or twelve days. In two months the seed drill is used for weeding, as the crop is too high and the fields are too full of water for the grubber. The weeds are always left to rot where they grew, and this constant supply of vegetable matter is one chief cause of the peculiar richness of the soil. The surrounding ridges are repaired, the earth cut from the front is heaped on the ridges, the beds are filled with water, and the leveller is passed over the crop. This gives the soil a smooth and beaten surface into which the water does not readily sink, but remains in pools.

The rice harvest begins about the 15th of November in the drier land, but many hollows where water lies deep are seldom ready for reaping before the end of December. An unusually dry or wet season may hasten or delay the harvest a fortnight either way. When rice is reaped it is left to dry on the field. It is then tied in sheaves, built ears outwards in a stock, and left to season for a month. A pole is fixed in the field, and the ground for a few yards round the pole is beaten hard and coddunged to prevent cracks. The floor is cleaned and swept, and the loosened sheaves are scattered over it, and six or eight muzzled bullocks packed side by side in a line are slowly driven over the sheaves round the pole. This goes on till all the grain has been trodden from the straw. The straw is then removed, and fresh sheaves are laid and trodden. Winnowing follows thrashing. Rice is winnowed by filling with grain a flat basket which is raised at arm's length and slowly emptied into the air with a slight and regular shake. The winnowing wind blows aside the dust and the leaves, and the clean heavy grain falls on the ground. When a heap

has been collected the grain is carried to the village, the outer husk is removed by a wooden hand-mill or *tolulikalū* (K.) and as before is a second time winnowed. When the operations are over, the rice is stored in a large round basket or wattle-and-daub safe, raised a little from the ground on beams laid across large stones, and roofed with thatch. Every husbandman's house has one grain basket in which rice and almost all other grains are stored. The only grains which are generally stored in pits are Indian millet, wheat, gram, and cajan pea. Nine chief kinds of rice are grown in Dhárwár. Of these two, *ámbe-mori* and *konksáli sanbhatta* are of good quality, three *bedarsáli*, *somsáli*, and *hakkalsáli* are of medium quality, and four *dodigan* a large grained variety, *hempgan* or red, *kerekgan* or black, and *gensáli* are of poor quality. All are sown at the same time, and are reaped one after the other at short intervals. In a fair proportion of rice fields sugarcane is grown once every third year. Where the soil has good natural moisture sugarcane is grown without watering, and, where the water supply is plentiful, with as much watering as may be necessary. The only cane which is grown without any irrigation, except a single flooding of the land when it is planted, is the small grass cane which is locally known as *hol-kabbu*. The cane which does not succeed without occasional watering during the dry season is the large or garden cane locally known as *gabras dali*. Green crops of *mug*, *pávta*, *matki*, and gram are also grown after rice in hollows which hold their damp till late in the year. Except in red and light coloured soils, a second crop of cane is seldom grown without watering.

TOBACCO¹ *háge soppu* (K.) or *tambáku* (M.) *Nicotiana tabacum*, with 1251 acres or 0·09 per cent of the tillage area is found chiefly in Ránebennur, Dhárwár, and Ron. Tobacco is seldom grown near the western forests, as the red gravelly soil does not suit it. It is chiefly raised in the east light-black soil. Rich alluvial soil is preferred, though, when watered, a mixture of red and black soil is found very suitable. The site of the tobacco field should be near the village as there it is more easily manured and guarded. Much less tobacco is grown than might be grown. Lingáyats, at least Lingáyats who have children, dislike growing tobacco, for they have to cut the young shoots and this sin is apt to bring sickness on the family. In June the seed is sown carefully in prepared beds. If the season is early, the seedlings are ready for planting in August; if the season is late they are ready in September. The field must be richly dressed with mixed pit manure. The leaves are ready for cutting in December or January. As a rule the whole plants are cut, stem as well as leaves. In most cases a poor second growth comes from the root and this second crop is allowed to flower and its seed is saved. The average acre yield varies from about three hundred pounds in Dhárwár, to two hundred pounds in Ron. At four pounds the rupee this leaves

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*Rice.**Tobacco.*

¹ From Mr. E. P. Robertson's letter 3261 of 20th September 1873 to the Revenue Commissioner S. D.

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Tobacco.

the husbandman a net acre profit of £4 to £6 (Rs. 40-60). The quality of the tobacco is not good; much of the home market is supplied from tobacco brought for sale from the banks of the Krishna. Tobacco is cured in three slightly varying ways. The stems, when cut are split, and for four to seven days are left in the field to dry. If there is dew they are left alone, if there is no dew they are sprinkled with water, or, in some cases, with a decoction of *kavási hallu* grass, catechu, and coarse sugar or *jágri*. The stems are buried four or five days, taken up during the cool of the day, dried, sorted, and tied for final disposal. The same plan is adopted if the leaves are plucked from the stem. In some places after the plants are cut they are left in the field for eight days, tied in bundles of twenty to twenty-eight, and carried home. They are piled in heaps with the leaves inward, and covered with matting to keep off wind and rain. After about a fortnight the mats are taken away, the tobacco is aired for a day, and heaped as before. This process is repeated four times when the tobacco is considered cured, and is sorted and tied into bundles. According to the third process after the leaves have been cut they are exposed to dew for ten or fifteen days, and if there is no dew the leaves are watered. The leaves are then fairly dried and buried with two layers of leaves and one layer of earth. After three days they are taken in the cool of the day and spread outside of the house. Two days later they are tied into bundles which are turned every eight days. At the end of a month the tobacco is cured. If tobacco is cut before it is ripe or if it has been over-fermented in curing it is apt to be attacked by insects. In 1872 Mr. E. P. Robertson, then Collector of Dhárwár, tried to introduce both Havana and Shiráz tobacco. The seed of these two exotics was sown in eighty-seven villages of which twenty-two belonged to Ron, thirteen to Gadag, twelve to Ránebennur, eleven to Karajgi and Sávanur, eight to Hubli, six to Kod, and four to Dhárwár. In some of the villages in which the seed was planted the crops withered from want of rain, but in many the crops came to maturity. In every case the husbandmen were pleased with the tobacco. Compared with the local tobacco it had much larger leaves, the crop was twenty-five per cent heavier, it was of a stronger and better flavour, and it fetched a higher price. Mr. Robertson doubted (1873) if the foreign tobacco could ever be well enough cured for the English market.

Sugarcane.

SUGARCANE *kabbu* (K). or *us* (M.) *Saccharum officinarum*, with 3742 acres or 0·28 per cent of the tillage area, is chiefly grown in the damp west or *málládu* and occasionally in gardens in the dry east. Except that when it is grown in a field it is planted in a field from which rice has been reaped, the garden and field tillage of sugarcane are much the same. The chief point is that the land must be damp enough. In December before the cane is planted the ground is prepared by breaking and levelling the rice-field ridges. After a week the small plough or *ranti*, with two or more pairs of bullocks, is drawn three or four times across the ground. The clods are broken by the *korudu* or leveller, and in January the heavy hoe or *kunti* and the light hoe or *ballesal kunti* are used to powder and level the surface. Manure is laid in heaps,

and, towards the end of January, the large plough cuts the surface into furrows about eighteen inches apart. In February, and in some places in March, the cane cuttings are laid in the furrow and covered with manure. Sugarcane wants more manure than any other crop; in fact cane can hardly have too much manure. Six to nine cart-loads are generally given to the acre. After the cuttings are covered with manure the small plough or *ranti* is run along the side of the furrows and fills them with earth. The field is then once well watered and wants nothing more till the rains. Eight or ten days after the planting, when the surface is dry, the *korudu* is used to level it and break the clods. The small plough is again used to heap the earth on the cane and is again followed by the *korudu*. After a few days the surface is loosened by the smaller hoe or *ballesal kunti* to help out the young sprouts and destroy the weeds. Nothing further is done till the first showers fall, when the crop is a few inches above the surface and the field is weeded by the grubber or *yadi kunti*. Now, if not earlier, it is hedged, and weeded as often as wanted, at first with the *yadi kunti* and later with the *kurgi* or drill machine. The earth is heaped about the roots, and the crop is ready for cutting in light porous soils in eleven months and in stiff soils in thirteen or fourteen months. Of eight varieties of sugarcane the chief are *hal kabbu*, *rámrasdali*, *gabrasdali*, and *kara kabbu*. The *hal kabhu* or grass cane, though the smallest variety, is considered the finest. It is white and thin, about the thickness of a good sized millet stalk. It is sown in rice fields and is considered a hardy plant. It is very largely grown because it has several advantages over the other varieties. It wants less water than the large white and red kinds. After it has once fairly taken root, little watering is required, the rain alone proving nearly enough. Though the larger cane gives much more juice it has much less saccharine matter in proportion than the small cane, and requires far more boiling to make *gur* or coarse sugar. The *gur* made from the small cane is also considered of superior quality. The *gur* of the small cane is light and granulated, while that of the large cane is heavy wiry and of a somewhat darker colour. On account of its hard bamboo-like texture the small cane is much less subject to the attacks of jackals and wild cats than the large cane. To sow an acre of *hal kabbu* requires 2500 to 3000 cuttings at three cuttings a cane. The *rámrasdali* cane is streaked white and red and is sown in rice fields as well as in gardens. It grows to a fair height and thickness, and an acre yields about ten loads of inferior *jágrí*, from which no sugar is made. The *gabrasdali* is grown in small quantities in garden lands for local use, and wants care and water once a fortnight. The skin of this cane is remarkably thin, the knots are far apart, and it is very juicy. It is much like the Mauritius cane. For an acre of *gabrasdali* or *rámrasdali* 5000 cuttings at five cuttings a cane are required. The *karra kabbu* is the common red cane. The other four minor varieties are the Mauritius or *morishyáda-kabhu*, *dodiya*, *byatalldodiya*, and *bile kabbu*. The Mauritius cane yields juice superior to that of the common cane,

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but, as it wants more water, and is more liable to be gnawed and eaten by jackals and porcupines its growth is limited. Sugarcane takes more out of the ground than any other crop. In fields sugarcane is followed by rice and in gardens by pot herbs. Unless the ground is richly manured, vegetables do not yield much during the first season after sugarcane. It is not till the second or third year that sugarcane can be again grown with advantage. In a fair season, on a rough estimate, an acre of sugarcane will bring a net return of £1 12s. (Rs.16). *Jágrí* or coarse sugar is made in a press of two upright solid wooden cylinders, on one of which is cut an endless male screw and on the other an endless female screw. These are set in pivots cut in a strong plank which is fixed at one edge of the bottom of a pit. The male screw cylinder is about a foot higher than the female, and into its head a horizontal bar is let to which are yoked two or more pairs of bullocks who keep the machine constantly moving. The cylinders are fed with pieces of cane about a foot long. *Hal kabbu* canes are passed once and *rámrasdali* canes are passed twice through the cylinders. The juice pressed from the cane runs into a trough, which forms the base of the machine, and from the trough passes into a broadmouthed earthen pot which is buried in the ground. When enough is gathered, it is carried to the boiler, a large flat iron vessel costing £1 12s. to £4 (Rs.16-40). The boiler is set on a brisk fire and is fed by the dried cane rinds. The boiling juice is constantly stirred, and the thick scum that rises to the surface is carefully removed till it becomes like syrup, when it is poured, if required for coarse sugar or *jágrí* into holes dug in the ground and after cooling is cut into cakes or dug out whole. If it is wanted for fine sugar, the syrup, after it is taken from the oven, is briskly thrown up the sides of the iron vessel by two or three men with long flat wooden ladles till it cools, and is finally broken into powder by oblong or oval-shaped single or double handled wooden blocks.

Chillies.

CHILLIES, *menasinakai* (K.) or *mirchi* (M.) *Capsicum frutescens*, with 28,748 acres or 2·16 per cent of the tillage area, is grown chiefly in the country between the woody west and the open east. The climate and the rich or *marikat* soil of Kod are particularly suited to the growth of chillies. The chilly is sown in May or early June in a small carefully prepared plot, often the backyard of the husbandman's house, and is well watered. In July, when of some little height, the plants are moved to the field, and are there set in rows two feet apart, which are laid out with the utmost regularity and precision. After the field has been planted, manure is applied by the hand to the root of each plant, and, at intervals of eight to ten days, the small two-bullock plough is carefully passed between the rows of plants, first lengthwise and afterwards across, by which the field is kept free of weeds, and, to keep the roots cool the earth is heaped round each plant. This earth-heaping is repeated for about three months until the branches of neighbouring plants begin to touch and the fruit appears. In December and January the crop is picked by the hand, generally in two pickings of which the first is

by far the largest. A good crop is said to yield about 400 pounds (16 *mans*) the acre which occasionally sells at about a penny a pound (Re.1 a *man*), a price which pays the husbandman excellently. The price is subject to very sudden changes. The chilly is used as a seasoning and though only very small quantities are required, a certain amount must be had at any cost. Thus in seasons of short crops the price runs very high, and, when the crops are large, the chilly becomes a glut and the price falls so low that short years sometimes pay better than full years. When grown as a garden crop the chilly is frequently mixed with the early watered *bellulli* or garlic and *ullegaddi* or onion.

Cotton,¹ *hatti* (K.) or *kápus* (M.) *Gossypium herbaceum*, averaging 335,900 acres or about twenty-seven per cent of the tillage area, is the most important crop of the Dhárwár black soil plain.² Little cotton is grown either in the hilly and woody west or in the patches of stony and hilly ground in the eastern plain. Three kinds of cotton are grown in Dhárwár: *Gossypium arboreum devkápus* (K.) (M.) that is God's Cotton, used in making sacred threads and temple lamp-wicks; *Gossypium indicum jvári-hatti* (K.) that is country cotton; and *Gossypium barbadense viláyati-hatti* that is American cotton. Of these three kinds *Gossypium arboreum*, a perennial bush eight to twelve feet high is grown occasionally all over the district, in gardens, beside wells and streams, and near temples. It is much like the Brazilian or Peruvian cotton plant, and, though this is unlikely, it is often said to be an American exotic. *Gossypium indicum, jvári-hatti*, generally known in the Bombay market as Kunta cotton, is largely planted all over the black-soil plain. *Gossypium barbadense viláyati-hatti* that is American cotton, commonly called Sawginned Dhárwár, which was introduced into the district by Government in 1842, has thriven well and has come to occupy about a quarter of the district cotton area. Among the cotton producing districts of the Bombay Karnátak, Dhárwár stands first, and both its American and its local cotton are highly esteemed. All evidence goes to show that with fair treatment in preparing them for market, the two varieties grown in Dhárwár will rank among the best cottons of India.

The upland plain of Dhárwár enjoys the unusual advantage of two rainy seasons, the south-west between June and October and the north-east or Madras between October and December. The north-east rains give the country a fresh supply of moisture in October and often again in November, and in a small degree still later on. This moisture with the cool November nights has had a large share in successfully acclimatizing New Orleans cotton. In the Dhárwár cotton plains the yearly rainfall ranges from twenty-five to thirty inches. During the cotton-growing months,

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¹ This account of Dhárwár cotton is prepared from a pamphlet written by Mr. W. Walton, late Cotton Inspector of the Southern Marátha Country.

² The area in the text is the average for the five years ending 1882-83. In 1881-82 the sub-divisional areas were, Gadag 79,537 acres, Navalgund 67,866, Ron 67,105, Hubli 44,865, Karajgi 30,497, Ranebennur 22,777, Bankapur 22,464, Dhárwár 13,069, Hángal 5668, Kod 3100, and Kalghatgi 753 acres. In 1881-82 the cotton area in Government and alienated villages was 534,000 acres; see below p. 302.

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that is from September to February, the returns for the five years ending 1882 show a greatest heat of 97° in February and a least heat of 58° in December. For cotton to thrive the soil should be loose and open enough to allow the air and sun to pass below the surface, and still more to let excessive and untimely rain drain from the roots. These qualities the crumbling gaping soil of Dhárwár has in an unusual degree.¹ The Dhárwár husbandmen describe their cotton lands as of two kinds: *huluk-yeri* which is a mixture of black and red soil and *yeri* a pure black soil. Both local and American cotton are planted in both these soils, but *huluk-yeri* or black and red is generally considered best for New Orleans cotton, and *yeri* or pure black for local cotton. The black and red is considered the richer of the two, but, in a bad season, blight and other diseases show themselves sooner and to a greater extent in black and red than in pure black. The great merit of these two soils is the surprising length of time during which the under-soil keeps moist. It is this under-ground dampness that enables the cotton plant, especially the American plant, to mature as late as March and April. When the surface of the field is baked and gaping with the heat the cotton bushes are still green because their tap roots are down in the cool moist under-soil. Cotton is seldom grown in red soil; the outturn is too small to pay at ordinary prices.

Watering.

Watering has often been suggested for Dhárwár cotton. Mr. Channing, one of the American planters brought by Government in 1842, recommended the damming of different parts of the Malprabha for the purpose of storing water to water the cotton fields. In 1865 the river was examined by the Collector and by Sir Bartle Frere, then Governor of Bombay, when on tour. The matter was referred to the irrigation department, but the costliness of the scheme prevented its being undertaken. Another scheme was to draw a supply of water from the Varda river; but the Varda scheme also proved impossible. Though both of these schemes were given up, the question whether watering the black soil cotton fields does good or does harm to the crop is still unsettled. The weight of experiments is against watering cotton in black soils. In 1858, experiments made on the Dhárwár border showed that, even with the help of water, cotton could not be profitably grown in red soils, and that in black soil watering positively injured the crop. Dr. Forbes-Royle, the superintendent of the Dhárwár ginning factory (1855), was of opinion that watering would be of use only in case of the failure of rain. Mr. W. Shearer, the superintendent of cotton experiments (1867-75), when want of rain threatened to destroy his crop, endeavoured to save it by watering. The only result was an improvement in the look of the plants. The watered plants yielded no more cotton than the unwatered plants, and the staple of the watered plants was exceptionally weak. So far

¹ An analysis of the best cotton soil showed in 4500 grains, 3324 grains of very fine soil, 936 grains of impalpable powder, and 240 grains of coarse pebbles like jasper, with pieces like burnt tiles strongly retentive of moisture. The impalpable portion consisted of 18·000 grains of water, 0·450 of organic matter, 0·083 of chloride of sodium, 0·007 of sulphate of lime, 0·027 of phosphate of lime, 0·0450 of carbonate of lime, 0·013 of carbonate of magnesia, 15·200 of peroxide of iron, 16·500 of alumina, 0·085 of potash, 48·000 of silica combined and free as sand, and 1·185 loss; total 100·000.

as Mr. Shearer's experience went, the only effect of watering either American or local cotton was to develop the plant at the expense of the fibre. The late Colonel Meadows Taylor, C.S.I., made experiments in watering Dhárwár-American cotton, and the result was a failure. The leaves were curled, the bolls soft, and the fibre weak. He agreed with Mr. Inverarity, then Collector of Broach, that watering cotton in deep black soil would prove injurious both to the quality and to the quantity of the fibre. The black or *regur* soil, in which cotton is almost always grown, is very deep and moisture-holding. Though the surface seems dry, and no doubt is dry as far as the plough or hoe has disturbed it, yet, after an ordinary rainfall, the under-soil always keeps moist, not only beyond the time at which cotton ripens, but even during the whole of the hot weather. The roots of the cotton plant strike very deep. The tap root passes at least two feet below the surface, generally three to four feet, sometimes as much as eight feet. Even the side shoots pass down when they find the surface soil begin to dry. A certain dryness in the soil is apparently needed to bring the fibre to perfection and to cause the bolls to open. Colonel Taylor thought that in deep black soil the ordinary rainfall was enough for the plant. Its whole growth, and for the most part its buds and flowers and green bolls were produced while the subsoil was wet. As the soil dried the stem of the cotton plant stiffened, the bolls hardened and ripened, and the cotton burst forth. If the ground was kept damp, there would be a danger that the plant would throw out fresh shoots and fail to ripen the bolls.

Cotton takes much out of the soil. Unless he is tempted by high prices, the Dhárwár landholder does not grow cotton oftener than once in three years. Still as it commands a sure and profitable market, cotton is often sown every second year, and in some of the richest soils it is grown season after season. Where it is planted season after season the crop is poor and the soil is much weakened. The area under local or Kumta cotton varies year after year with the labour market, that is with the quantity of labour forthcoming for cleaning. Thus, if labour is scarce and dear and the farmers find they have a large balance of unginued native cotton in stock, they will not sow that year as much as they would have sown if their stock had been sold and labour was cheap and plentiful. The area under cotton is also affected by the balance of grain and bread stuffs in hand, and also by the rainfall. If the rain is heavy in the early part of the season, there is a large sowing of millet and other wet crops; if the rain holds off until August or September, there is a large area under cotton, but, if the August rain also holds off and there is but little rain till October, wheat and gram take the place of cotton. Cotton fields are manured some time before the cotton is sown. The husbandmen say that if manure is put in along with or immediately before the cotton seed and the rainfall is scanty, the manure does not mix with the soil, and injures the cotton plant especially the American plant. The manure used is pulverised village refuse and rubbish, and occasionally oil plant or some other quick growing crop is raised and ploughed in. The soil is generally manured every second or third year.

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Tillage.

Many of the better class of husbandmen take great care in preparing their cotton land. It is cleared of all the stumps of the previous crop by the heavy hoe or *kunti*. Wherever it is overgrown with the *karige* (K.) or *hariáli* (M.) *Cynodon dactylon* grass, the land is ploughed with the heavy plough. Even repeated workings of the heavy plough do not always succeed in uprooting the entangled and deep rooted *hariáli*. Field labourers are engaged who turn out with pickaxes or *kudlis* (K.) and dig the land often two feet deep. This is very slow and hard work, but the result repays the severe labour and the expense. After ploughing, or deep digging, the heavy hoe or *kunti* is again used to thoroughly loosen the soil. When the soil is thus broken and smoothed it is considered ready for the seed. The Dhárwár husbandmen take the greatest care not to sow cotton at any time which will bring the plant to maturity at a season when heavy falls of rain may be expected. As a rule cotton sowing begins in the latter part of August. By this time the land has been thoroughly soaked, and is so far drained that the surface is comparatively dry. A fairly dry surface with much moisture below is the state in which land should be for sowing either American or local cotton. Soil in this state helps the seed to sprout and draws the tap roots deep enough to support and bring the plant to perfection, when the hot weather and the trying east winds set in. Before sowing it New Orleans seed is rubbed by the hand on the ground in a mixture of cowdung and water; for their woolliness keeps the seeds from running freely through the seed drill. The seed is sown with the aid of the *kurgi* or seed drill which has iron teeth eighteen inches apart, to each of which a hollow bamboo tube called *yellishedí* (K.) is fastened. Bullocks are yoked to the seed drill, and, as they work, the iron teeth plough two drills, and in these drills the cotton seed is dropped through the bamboo tubes. The seed drill is immediately followed by the hoe which closes the drills. Frequent hot sunny days after sowing promote sprouting and about three months more remain during which from time to time rain may be looked for. The seed leaves begin to show in six to twelve days. In about a month, when the plants are three or four inches high, the farmer takes his grubber or *yadikunti*, and works it between the cotton plants, doing two rows at a time. The grubber roots up all young weeds and grass. At the same time it turns the surface soil, keeps it from souring, and heaps the soil at the roots of the young plants. This heaping of the soil is repeated several times, the oftener the better, until the plants grow too high to work the grubber. The more hardworking and careful husbandmen supplement the grubber with hand labour. For this men, women, and children are employed on 3*d.* to 6*d.* (2-4 *as.*) a day, weeding at surprising speed with a *kurchegi* or miniature sickle. By the beginning of October, a strong, dry, cutting east wind sets in. The east wind lasts till about the middle of November, when the strain is eased by occasional moist southerly and westerly breezes and timely heavy thunderstorms. After this the dry east wind again sets in and blows steadily till January. The American cotton plant usually flowers in December, often ten days to a fortnight in advance of the local plant. Its cotton bolls mature in February and March. A good American

crop usually yields five pickings, with a week between each; a poor crop not more than three pickings with a fortnight between each. All of the picking, and, in the case of the local cotton, almost all of the ginning, is done by women and children, the men's share in the labour ceasing when the plants are full-grown.

Crossing has very often been tried in Dhárwár with a view to improve the different varieties. Attempts have especially been made to cross the local plant either with New Orleans, Sea Island, or Egyptian, so as to keep the hardiness and strength of the local plant, and gain the silkiness, length, and large outturn of these foreign varieties. So far back as 1859 the Bombay Chamber of Commerce explained the decline in the quality of Dhárwár American cotton to natural crossing, the result of mixed sowing of the local and foreign varieties. Such a result Dr. Wight (1842-1850), a botanist and a practical cotton planter in Koimbatore, thought impossible. In 1872, Mr. Shearer stated that in his experience the cotton of plants grown from seed that had been looked on as crossed, on coming to maturity, showed no marked improvement on those of the parent plant. The only difference was in appearance. Plants obtained by crossing local and Egyptian grew well, but their bolls did not ripen. A cross of Egyptian or Sea Island with American seemed always to run out and the plants dwindled after the second year. If they ever produced bolls the staple was weak. Mr. Shearer tried to cross the different local varieties. The look of the plant often changed, still he could not say whether they were crosses or sports. Mr. Shearer traced the apparent changes, which often deceive an unprofessional eye, to difference in season, situation, and tillage.

Dhárwár cotton is liable to two diseases, *benithgi rog* (K.) and *karaghi rog* (K.). *Benithgi rog* is brought on by continued hard cutting easterly wind; it turns the leaves red and blights them; the flowers and pods fall off without maturing and the plant slowly dies. *Karaghi rog* is brought on by cutting easterly winds with heavy morning dews and fogs; it disappears if a westerly wind sets in before the disease has gained too strong a hold.

According to the season the acre yield of clean cotton ranges from fifty to 120 pounds, the yield of American cotton being greater than that of country cotton. According to the 1882-83 cotton report, during the five years ending 1882-83, the acre yield was estimated at fifty pounds of American cotton and forty-two pounds of local cotton. The cost of growing cotton is difficult to determine. Much depends on the grower the number of cattle he owns, the area of land he holds, the number of persons in his house, and many other conditions which more or less affect his actual cash outlay in growing cotton. Roughly the acre cost of growing American and local cotton is 11s. 4½d. (Rs. 5½). As the value of the American crop may be set down at £1 10s. (Rs. 15) and the value of the local crop at £1 4s. 9d. (Rs. 12½) the American leaves a net profit of 18s. 7½d. (Rs. 9½) and the local of 13s. 4½d. (Rs. 6½). To the net profit on the country cotton a small amount may be added, as in many cases the husbandman's family themselves clean the cotton.

In 1819, a year after Dhárwár passed to the British, the commercial resident in the ceded districts, recommended that

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50,000 to 100,000 pounds of Brazilian cotton seed and some quantity of New Orleans and Sea Island cotton seeds should be procured and distributed in Dhárwár. To tempt the husbandmen to try these foreign cottons it was proposed to offer a reward of £17 10s. (50 *pagodas*) in cash or in the shape of a gold medal and chain on the first delivery of five hundred pounds of clean white cotton free from seed dirt and leaf, that is at the rate of about 17s. 6d. (2½ *pagodas*) for each *man* of twenty-five pounds. This proposal was approved by the Madras Government, but it does not seem to have been carried out. In 1824 it was noticed that much land fit for growing cotton lay waste. The cost of clearing rich land was so great that a lease or *haul* of nine or ten years of light rent was not inducement enough to tempt the people to undergo the expense. In 1829 under orders from the Court of Directors, to improve local cotton and introduce fine foreign varieties, experiments were begun in Dhárwár under Dr. Lush, who, in addition to his ordinary duties as superintendent of the botanical gardens at Dápurí in Poona, was entrusted with cotton experiments in Khándesh and Dhárwár. Dr. Lush reached Dhárwár too late in the year to sow cotton. He bought some fields of growing plants, and proposed to clean cotton in a way which could increase its value without adding much to its cost. He also proposed to distribute the seeds of the best Gujarát, New Orleans, and other annual cottons, which would ripen in the course of the season, so as to produce new varieties of the staple. The cotton bought and cleaned by Dr. Lush was favourably noticed in England and was valued at 5½d. to 5¾d. (3¾ - 3⅝ *as.*) the pound, when Indian cottons were selling at Liverpool at 3d. to 6d. (2-4 *as.*) the pound. In the next season Dr. Lush chose land for a small cotton farm at Sigihalli in the Khánápur sub-division of Belgaum. The land was so situated that, if necessary, it could be watered by a stream. Partly owing to a bad season, but chiefly owing to the damaged state in which the foreign seed was received, the experiment failed; the entire crop sent to England amounted only to four bales. Of these four bales two, of a kind not recorded, were valued at 7½d. to 8½d. (5-5½ *as.*) the pound, one of American upland seed at 8d. to 8½d. (5½-5¾ *as.*) the pound, and one of Dhárwár New Orleans at 8d. (5½ *as.*) the pound. At this time the average price of Indian cotton in England was 4¼d. (2⅝ *as.*) the pound. In spite of these high prices all four packages turned out unfit for spinning. Small quantities would still command the high prices named for candle-wicks and jewellers' purposes. The cotton was cleaned by a foot roller so ineffectively that the work had to be supplemented by a number of hand-pickers behind the foot rollers, who had to pass the whole of the ginned cotton through their hands and remove from it the broken seeds and dirt that had passed the roller. £6 (Rs. 60) were spent in cleaning 784 pounds of cotton. The landholders were unwilling to go on trying foreign seed. The yield was less and the quality was poorer than that of the local cotton. About this time (1829) a quantity of Broach cotton cleaned by the foot roller sold for 5¾d. to 6d. (3⅝-4 *as.*) the pound.

Between 1829 and 1832 the results of the sowings of American cotton seed at Naval Gund, Dhárwár, and Morab were various. The seed was liable to fall off in quality, they withered, and got to look like the seeds of poor black-seeded cotton. In proportion to the seed distributed Dr. Lush received very little cotton. Some American seed sown as perennial and tried at the Sigihalli farm failed. Some Broach and Jambusar seed was tried at Naval Gund, but the pods were attacked by field bugs, and the produce was poorer than that of the local cotton. About 1830 a small trade in Dhárwár cotton sprang up with China, and the Canton merchants highly approved of the consignments that were sent to them. In 1831 at the Sigihalli farm, five pounds of Pernambuco seed at first promised well, but the plants were afterwards blighted. In November 1832 the plants were recovering, but up to that time there had been no outturn. Some Bourbon seed was tried with Pernambuco, but it did not come up. Some seed of a white-seeded perennial from the Dápurí garden was thought likely to turn out a fine silky cotton, and was prepared by the saw-gin. In 1832 some Egyptian was tried, and in November, Dr. Lush, notwithstanding a dry season, thought it more promising than the other varieties. During 1833 the results continued most discouraging. The Pernambuco was a complete failure in black soils and the American green-seeded varieties, that is Georgian Uplands and New Orleans, were found to degenerate rapidly and to yield thin unsatisfactory crops. In 1834 Dr. Lush thought Pernambuco might succeed in fairly moist red soil. Pure black soil was death to this seed. In 1835 experiments at the Sigihalli farm convinced him that Pernambuco would never answer in Dhárwár. He thought Egyptian might succeed as an annual, as it bore a good crop the first year, and the proportion of its wool to seed was double that of the local cotton. In 1836 the Collector, Mr. Baber, while giving his opinion on the Sigihalli farm, said that though the experiments had gone on for five years, not a single landholder close to the farm had in the slightest degree changed his mode of cotton tillage, of gathering the crop, or of preparing it for market. About this time Dr. Lush showed that a new ginning machine was required, as the foot roller was not suited to foreign cotton, and as the American gin was a failure. In 1836 the Dhárwár experiments were closed. They were considered to have failed after a fair trial. Still Mr. Mercer the American planter, when looking over a collection of experimental cottons at the India Office in London in 1840, picked out samples of Dr. Lush's white-seeded perennial which he said were quite equal to good New Orleans.

In 1838 several commercial bodies in Great Britain urged measures for improving Indian cotton. In consequence of this agitation, Captain Bayles of the Madras Army was sent to America to engage the services of trained men to teach the people of India how to grow and prepare cotton. Ten American planters were engaged and started for India in 1840 with a large quantity of the best cotton seed, some American tools, cotton gins, and presses. Of the ten planters three came to Bombay. In 1841 the Collector, Mr. A. N. Shaw, to whose steady and persevering

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efforts much of the success of the attempt to acclimatize American cotton in Dhárwár is due, planted, on the local system, some ten acres in Hubli with some of the Mexican seed sent by the Court of Directors. Mr. Shaw believed that of all Western Indian climates the Dhárwár climate was most like the climate of the United States cotton-growing districts. Mr. Shaw was right, and his cotton, though the seed was old and though the plants were grown under many disadvantages, was declared by the local landholders and merchants better than their own, and was valued by the Bombay Chamber of Commerce at £1 to £1 10s. (Rs. 10-15) the *khandi*, that is twelve to eighteen per cent, higher than the best Broach, then the standard staple at Bombay. Mr. Shaw's fields gave ninety pounds of clean cotton the acre, while the neighbouring fields sown with local cotton returned only forty-five pounds the acre. Mr. Mercer one of the American planters, who reached Dhárwár about this time, was so satisfied with Mr. Shaw's fields, that his doubts of American cotton becoming a valuable Indian product disappeared. In spite of his success Mr. Shaw thought that no rapid spread of American cotton was possible, unless a simple portable gin was introduced. At this time most of the landholders were deep in debt and worked without spirit. The ordinary way of gathering the cotton crop was to let it fall on the ground and lie on the ground till the cotton bushes ceased bearing. Then the people went out and gathered it all in one gathering. They mixed the fresh and the old, making no attempt to separate the clean from the dirty. About the same time (1841-42) Mr. Hadow, then assistant collector, grew some Bourbon seed cotton on the native plan in the black soil of Gadag. The return was thirty-one pounds of clean cotton the acre. Bourbon is a perennial and seldom yields more than thirty pounds during the first season. The sample cleaned by the foot roller was especially praised by the Chamber of Commerce for its beautiful cleanness. In 1843 Mr. Mercer, with his assistants Messrs. Hawley and Channing, began an experimental cotton farm at Kusvugal five miles north-east of Hubli. The system was that followed by the Dhárwár husbandmen. The only change was that seed was sown at intervals from early June, while the local husbandmen never sow till late in August. In this year 545 acres were under foreign cotton. Of these 183 were planted by Mr. Mercer with six different varieties, eighty acres with New Orleans, sixty-three with Broach, sixteen with Koimbator from acclimatized New Orleans seed, eleven with Abyssinian, ten with Bourbon, and three with Sea Island. The result at first was discouraging, mainly owing to the effects of the constant high winds of the early months of the south-west rains. By September appearances greatly improved and Mr. Mercer described the prospect as truly promising. This was the case not only with the experimental farm but also with the fields of the local farmers. In spite of damage caused by heavy rain early in October, which also told on other cotton fields, Mr. Mercer considered his outturn better than any he had seen in India. The acre yield of clean cotton was fifty-four and a half pounds of New Orleans, thirty-two pounds of Broach, fifty-four

pounds of Koimbatore, and eight pounds of Abyssinian. Bourbon and Sea Island gave no return. The Kusvugal husbandmen's returns were at the rate of forty-eight and a half pounds the acre on their fields of foreign cotton, leaving them six pounds behind their American rivals. From these results Mr. Shaw hoped by 1845 to see Dhárwár cotton hold a high place among Bombay cottons. To meet the ginning difficulty twenty-four ginning wheels or *charkás* and five saw-gins, cleaning 300 to 350 pounds of cotton in a day, were procured, and several gin-houses were opened. In Mr. Shaw's opinion, and this opinion experience has proved correct, New Orleans cotton yields a larger acre outturn than local cotton. New Orleans is also more easily gathered free of dirt than the local cotton. Its covering leaves or calyx are tougher and thicker, and less apt to break and mix with the fibre than the local covering leaves. The local cotton is also more apt to be damaged by falling on the ground. Further the proportion of wool is larger in New Orleans than in the local cotton. In a hundred pounds of New Orleans thirty-three pounds are wool, sixty-six pounds seed, and one pound waste; in a hundred pounds of local cotton twenty-four pounds are wool, seventy-five pounds are seed, and one pound is waste. Except that they were ill-ginned, parcels of the 1843 experimental cotton were favourably noticed by the Bombay Chamber. Mr. Hadow's experiment with Bourbon at Gadag did not pay its cost in the first and second years (1842-43). In the second year (1843) it was under the care of Mr. Hellier, a German, to whom it had been made over by Mr. Hadow. In Mr. Shaw's opinion the result showed that no further experiments should be made with Bourbon. It would never be a success and all experiments with it would only interfere with the efforts to spread the cultivation of New Orleans. Mr. Mercer agreed with Mr. Shaw, and added that the outturn of Bourbon was less than that of the local cotton. Shortly after this Mr. Shaw went to England. He was succeeded by Mr. Goldsmid, who, as well as Mr. Mansfield the first assistant collector, took much interest in the cotton experiments.

In 1844-45, 2749 acres were under American cotton. A second experimental farm of 168 acres, of which 146 were under New Orleans and twenty-two under Broach, was started near Gadag under Mr. Hawley, while Mr. Mercer continued his experiments at Kusvugal. Mr. Hawley met with remarkable success. His New Orleans gave an acre return of 94½ pounds of clean cotton and his Broach of 123½ pounds. Some of the fields would have done credit to the banks of the Mississippi. Mr. Mercer's plants were attacked by field bugs and caterpillars and yielded poorly. The acre return of clean cotton on 150 acres of New Orleans ranged from eighty-one and a half to fourteen and a half pounds. The return on sixteen acres of Broach gave an average of sixty-three pounds, ten acres of Bourbon gave an average of twenty-two pounds, and eleven acres of Abyssinian an average of ten and a half pounds. In this season both Mr. Mercer and Mr. Hawley tried manure. In 1845 the experimental farms were closed on the ground that it was no longer necessary to supply the people with American seed. Twelve saw-gins were at work, seven private and five Government, but to meet the people's wants at least twenty more were required. In 1845-46 the rains

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were disappointing, and instead of 17,000 acres only 11,176 acres were planted with American cotton. In this season the planters were allowed to raise cotton for Government by contract with the landholders. Mr. Mercer paid 4s. (Rs. 2) for tillage, 2s. (Rs. 1) an acre for land rent, and, after paying all other expenses, 7s. (Rs. 3½) the acre for carrying the cotton to the ginning house. Mr. Mercer calculated that, at an acre yield of sixty-three pounds of clean cotton, the crop would cost the husbandman 1½d. (1 a.) the pound. After giving credit for the value of the seed it was found that the crop represented an outlay to the grower of very little over a penny a pound. The whole produce of the district was calculated at 1200 to 1500 bales of American cotton. The growth of American cotton was left entirely to the people. But Government were the only buyers and there were no saw-gins to gin it. The want of saw-gins was the great drawback to the spread of American cotton, as the people would not grow American cotton unless they were sure that they could clean it and sell it. In June of the same year (1845-46) Mr. T. W. Channing, one of the American planters at Kusvugal, brought to the notice of Government that the American saw-gins were not suited to the acclimatized varieties, and that better and cheaper saw-gins might be made in India. He thought that by making them on the spot the price of a saw-gin might be lowered from £35 to £19 16s. (Rs. 350-198). A gin made under Mr. Mercer's directions cost only £14 14s. (Rs. 147). At a trial made by Captain, the late Sir George Wingate, then superintendent of the revenue survey, the local gin beat the American saw-gin by twenty-five per cent. Mr. Mercer asked for a good European mechanic. Instead of this, and this was probably a better arrangement, the Court of Directors sent out 500 saws the only part of the gin which could not be easily made in Dhárwár. It is in great measure to the arrangements which were then made for cleaning the cotton that Dhárwár owes its special success in the growth of saw-ginned Dhárwár.

In 1846-47, for the first time, local dealers bought American cotton on their own account, and at rates twenty per cent over local cotton. Mr. Hawley soon after resigned and was succeeded by Mr. Blount, also an American, who had come from Khándesh. Mr. Mercer left at the end of 1846. About the same time the tests made by Lancashire spinners on Government shipments of Dhárwár New Orleans showed a loss of twenty-one pounds on 332 pounds of Dhárwár New Orleans before carding, compared with a loss of 38½ pounds on an equal quantity of common Surats. After carding the losses on similar quantities were sixteen pounds of Dhárwár New Orleans and 28½ pounds of Surats. When spun fifty pounds of ordinary American New Orleans showed a loss of 17½ per cent and an outturn of 41½ pounds of yarn, while the same quantity of Dhárwár New Orleans turned out 42½ pounds of yarn with a loss of fifteen per cent. The yarn of Dhárwár New Orleans was pronounced equal to yarn made from ordinary American New Orleans. In May 1846 Mr. Mansfield, then acting Collector, recommended Government to cease holding out special inducements for the growth of American cotton. The people were willing to sow it to any extent, provided Government guaranteed them a sale. After another year, if the merchants did not step in

and help in creating a demand, he did not see why Government should foster the production of an article which had no fixed market value. In a second letter about the end of the year, Mr. Mansfield urged that the uncertainty of the price of Dhárwár New Orleans cotton in Bombay was the doubtful point in the experiment. Until something was done to ensure a demand for the cotton, the burden of buying the entire crop would continue to fall on Government. He thought that part of the Dhárwár American crop should be offered for sale in Bombay. Government approved of selling some of the cotton in Bombay, but were unable to offer it for sale as the Court of Directors found that the opinion had lately spread in England that the recent shipments of good cotton were pet packages from cotton grown as a garden crop. The Court were therefore anxious to have as much cotton as possible to show that the better class of cotton could be grown in sufficient quantities for trade purposes. One bale was left in Bombay for the inspection of merchants. Towards the close of the year Mr. Townsend, the Revenue Commissioner, represented the results of the Dhárwár cotton experiments as encouraging. The weak point was the want of a suitable provision for ginning. Government agreed with Mr. Townsend that Mr. Mercer's efforts to establish American cotton had been to a great extent successful. In 1847-48 20,500 acres were under New Orleans cotton. At first an outturn of over 700 tons (2000 *khandis*) was expected; later on it was found that the unfavourableness of the season would reduce the outturn by one-third. Twenty-nine saw-gins were at work in the district and many more were wanted. About this time the American planters, brought by Captain Bayles, expressed the opinion that New Orleans cotton would succeed only in districts which like Dhárwár shared in the two monsoons. Early in 1848 Mr. Goldfinch, the first assistant collector, discovered that in many villages the persuasion of the village authorities to get the landholders to grow American cotton had differed little from compulsion. Mr. Bell, the Collector, satisfied himself that Mr. Goldfinch was correct. Persuasion was stopped and the area of American cotton fell from 20,500 to 3350 acres. The people had grown American cotton because they had been ordered to grow it. Still in parts of the district they would grow New Orleans from choice, if only they could be sure of a market and had less trouble in getting it ginned. In this year (1848-49) the New Orleans crop was excellent, upwards of ninety pounds of clean cotton an acre, and it yielded such admirable seed that the character of the cotton was permanently improved.

In 1849-50 over 15,500 acres or five times as much as in the year before were under New Orleans. The increase was due to a better understanding with the people and better ginning arrangements. 1849-50 was one of the best New Orleans seasons. It was a bumper crop, and very much more of it than in any former season was ginned in the husbandmen's gins, which had risen from five to sixty-two. Still, either because there were still not enough gins or because the gins were badly worked, the ginned cotton was unsatisfactory. The unsatisfactory state of the Dhárwár cotton was not confined to the American cotton. The local cotton was at

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this time the dirtiest and the most fraudulently packed cotton that came to Bombay. Up to 1849, apart from what the sales of the cotton realised, Government had spent £20,000 (Rs. 2,00,000) on cotton experiments in Dhárwár. In 1850-51 over 31,000 acres were under New Orleans, Shiggaon, now Bankápur, showing nearly 13,000 acres or an increase of 200 per cent over the previous season. In the Liverpool market this cotton fetched $3\frac{1}{2}d.$ the pound. In 1851-52 over 42,600 acres were under New Orleans, of which 17,000 acres were in Bankápur and 700 acres in estate or *jágir* lands. In this year Government gave up buying cotton. By this time Dhárwár New Orleans had gained so high a name in England, that the agents of Manchester firms in Bombay were ordered to make large purchases, and, in 1851, Dhárwár New Orleans was sold in Dhárwár at $3d.$ a pound (Rs. 100 a *khandi*). In 1852-53 a difficulty regarding the repair of the saw-gins reduced the acreage to a little over 28,000 acres, exclusive of nearly 8800 in estate or *jágir* lands. Great exertions were made at the Dhárwár ginning factory to meet the want of gins, and they were so far successful that in the next year 184 gins were in use, and the area rose to 41,403 acres, of which nearly 10,000 were in estate lands. This success was the more satisfactory that in this year Government had withdrawn from ginning as well as from buying. In 1853-54, 41,403 acres were under New Orleans and 252,006 acres under local cotton. In 1854-55 upwards of 63,000 acres in Government lands and more than 18,250 in estate land were planted with New Orleans. During these years the area under local cotton varied from about 223,000 acres in 1850-51 to 210,260 acres in 1854-55. During the same years the price for a *khandi* of 784 pounds of New Orleans varied from £7 10s. to £9 10s. (Rs. 75-95), and of local Dhárwár from £6 to £8 (Rs. 60-80), that is an average of £1 10s. (Rs. 15) or $18\frac{3}{4}$ to 25 per cent in favour of New Orleans. Compared with what he had seen between 1843 and 1850, in 1854 Captain, now General, Anderson noticed a marked improvement and extension in cultivation. The fields were kept carefully cleaned and manuring had become so common, that in some parts crops were grown to be ploughed in as manure. Some Bankápur cotton growers owned to occasionally getting 500 pounds of seed cotton to the acre, and 300 to 390 pounds was not unusual. During the thirteen years ending 1853-54 the mean price of a bundle or *nug* of 300 pounds of clean cotton was £1 19s. 3d. (Rs. 19 $\frac{5}{8}$) in Navalgund and £2 10s. (Rs. 25) in fifteen other cotton centres. At the same time the Government rental had been reduced to an acre average of $9\frac{3}{4}d.$ In 1855-56 defective ginning arrangements reduced the area of New Orleans cotton to 50,803 in British and 15,711 acres in estate lands. In the same year 202,843 acres were under local cotton. In 1856-57, 108,207 acres were under American and 196,931 under local cotton.

In 1857-58 the area under New Orleans was 130,880 acres and the area under local cotton 252,850 acres. In this year several experiments were made with Egyptian cotton seed. The Collector found the plants grow remarkably well. They were much larger and finer bushes than the New Orleans, but the pods rarely matured and were very liable to be destroyed by insects.

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An experiment made with watered Egyptian failed. Messrs. Brice & Company, who since 1854 had opened a trade agency at Dhárwár also made experiments with Egyptian and failed. They inclined to attribute their want of success to the exceptional lateness of the rains, which did not set in till the middle of October and then lasted for a month. At the beginning of March the plants were full of pods and promised a rich crop; but the dry winds of March and April were too severe a trial, and the pods fell without yielding cotton. The Collector did not agree with Messrs. Brice & Company that the failure had been due to untimely rainfall. In his opinion Egyptian cotton was not suited to the district. The weather described by Messrs. Brice & Company had done little harm, either to the New Orleans or to the local crop. The details of Messrs. Brice & Company's experiments show that one at Gadag failed entirely; the plants came up and then died away. At Bankápur the experiment promised well to the end of February; but by the middle of April 6800 plants gave only twenty-six pounds of seed cotton on first and second pickings. They yielded no more cotton, and animals were allowed to graze on the plants. At Hubli 8124 plants gave 106 pounds of seed cotton, which, on being ginned, gave thirty-two pounds of wool, seventy-one pounds of seed, and three pounds of waste. These experiments with Egyptian seed were on a fairly large scale as they covered 169½ acres including sowings in five sub-divisions and 5¼ acres in Sávanur. The result was a mean acre return of about twelve pounds of clean cotton. But as the cotton was valuable, its estimated price reduced the computed loss on the experiment to about 10½*d.* (7*as.*) an acre. Up to May 1857 cotton improvements in Dhárwár had cost Government £42,463 12*s.* (Rs. 4,24,636). Some of this large outlay was recovered in the sale of consignments of Government cotton in England. In 1858-59 the cotton area showed an increase of 4000 acres in Government lands, and from some unexplained cause a decrease of 10,000 in *jágir* lands. The whole area under New Orleans was 124,752 acres, compared with 214,993 acres under local cotton. The experiments to introduce Egyptian cotton were continued; 261 acres were planted in seven sub-divisions. The result was again unsuccessful, the mean acre yield of ginned cotton being barely fifteen pounds and the net acre loss on tillage nearly 1*s.* 9*d.* (14*as.*). As in the previous year, the plants grew vigorously and bore quantities of bolls; but most of the bolls never ripened. The assistant collector, who managed much of the experiment, stated that he had not seen one single instance of success with Egyptian cotton. Samples of the small Egyptian outturn together with samples of ordinary Dhárwár New Orleans were sent to the Bombay Chamber of Commerce. The Egyptian was valued at 1*s.* the pound and the New Orleans at 6*d.* In 1859 the Dhárwár cotton growers were very flourishing, mainly owing to the handsome profits which American cotton yielded. In 1859-60 increased ginning facilities raised the area under New Orleans by fifty per cent, the total area being 191,282 acres. At the same time the area under local cotton was 230,665 acres. In this year fifty-six gins were issued from the Dhárwár ginning factory. A third experiment with Egyptian ended much like the former

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attempts, and the Collector, Mr. Goldfinch, considered the variety unsuited to the soil. An English merchant, Mr. Brook, made fairly large experiments with Egyptian and Egyptian Sea Island. Mr. Brook was of opinion that these cottons would succeed if they were sown much earlier than the local cotton. This theory was tested. The result showed that Mr. Brook was to a certain extent correct. Where good seed was used, the plants thrived amazingly, and so far as size and appearance went, beat all other varieties. They went too much to wood and leaf, but still seemed likely to yield largely. They matured much sooner than the other cotton. The crop was ripe early in October, when a heavy burst of rain almost yearly falls. The rain fell and the cotton was spoiled. What was picked was weak in staple. This and their own experience so disappointed the landholders, that they refused to try any more Egyptian at their own risk. In 1860 the practice of mixing local and New Orleans brought New Orleans into disrepute, and it lost much of its value. The Bombay Chamber of Commerce thought the falling off was due to crossing. Further inquiry showed that this was a mistake. Dr. Forbes' conclusions were more correct. He thought the decline was due to wilful adulteration, and to the cultivation of local and American in the same field. Both kinds were picked and ginned together, and as the local cotton was cut to pieces in the saw gins, the thorough mixture injured the whole. So greatly did the New Orleans suffer that during the ten years ending 1860 its value had fallen from seven-eighths of a penny above to a quarter of a penny a pound below Broach. That this fall in value was not due to a deterioration in the New Orleans seed was proved by growing two packages, one from fresh New Orleans seed and one from ten years old, that is ten times cropped, New Orleans. The Bombay Chamber valued the fresh seed cotton at $6\frac{1}{2}d.$ and the old seed cotton at $6\frac{1}{4}d.$ a pound. The only difference was that the staple of the old cotton was slightly weaker. In 1860-61, 191,026 acres were under American and 234,452 acres were under local cotton. Fifty-five new gins were issued, and gins were still in great demand. In 1861-62 New Orleans rose to 214,310 and local cotton fell to 200,491 acres, and forty-two more gins were sold, making a total of 884 working gins. In 1861 besides proving that the decline in the value of New Orleans was solely due to mixing, Dr. Forbes, with the help of the district officers, succeeded in getting the people to root local plants out of New Orleans fields. The result was a marked advance in the value of the 1861 New Orleans. In 1862 the mixing was again as bad as or worse than ever. In 1862 Dr. Forbes with Mr. Heywood a leading Manchester merchant, went to see a gin-house. On entering the courtyard, which was enclosed by a high wall, they saw on one side a large heap of trashy local cotton, and near it another heap of about the same bulk of fair American seed cotton. The space in front of the gin-house was covered with a mixture of the two heaps spread in the sun to dry, and on this mixture the gins were at work. Dr. Forbes found that the husbandmen blamed the ginners for the mixed cultivation. The ginners, they said, returned them mixed seed, and this they had to sow.

The ginner said the fault was with the husbandmen who gave them mixed seed cotton to gin. The charge was generally brought home to the ginner. Dr. Forbes found that in the Hubli saw-gins the American and local cottons were being mixed. Mr. Everitt, an English merchant at Dhárwár, found mixed ginning spreading so rapidly that he had to close his Dhárwár business. Dr. Forbes wrote that the American was now more than half local, and that too of the worst description. Mr. Gordon, the Collector, said that he and his assistants were powerless to prevent the mixing, and that it must do great mischief to the cotton trade. Mr. Hart, the Revenue Commissioner, agreed with Mr. Gordon that this mixing should be stopped and that passing an Act was the only way to stop it. Dr. Forbes was satisfied that fear of the law was the only way of stopping the mixing. The owners of gin factories were rapidly growing rich. He had orders for 591 gins worth £17,800 (Rs. 1,78,000) from people who a few years before could not buy a few gins worth £3 or £4 (Rs. 30-40). As Dr. Forbes' opinion was upheld by almost all the officers who were consulted, Government appointed a Commission to inquire into cotton adulteration.¹ Three members of the Commission, Messrs. Forbes Scott and Hannay, came to the Bombay Karnátak to inquire into the state of the Dhárwár cotton trade. They found that, during the season in which the inquiries were made, little or no local or American cotton had been shipped clean or unmixed. Besides the mixing of different varieties of cotton the dealers admitted that their cotton was mixed with seeds and other rubbish, and that it compared badly with the exports of former years. Many of the local dealers were anxious that the trade should be regulated by law and placed under inspection. In their report the Commissioners stated that the evils of the Dhárwár cotton trade were beyond usual remedies, and affected not only local but general interests. Nothing but the energetic action of Government could check so widespread an evil. Existing laws were insufficient, a fresh Act was required. With their report they submitted the draft of a Cotton Frauds Bill, which had been prepared by Mr. Scott one of the Commissioners, and which had been altered and completed in accordance with the opinion of the Commissioners. This measure, with some amendments, was brought before the Legislative Council early in 1863. It passed in April 1863, and became law in July of the same year as the Bombay Cotton Frauds Act IX. of 1863. The first cotton inspector appointed for Dhárwár was Captain, now Colonel, R. Hassard, of the Bombay Staff Corps, who had already received charge of the Dhárwár factory from Dr. Forbes, on his appointment as Cotton Commissioner. Captain Hassard's duties of superintendent at a chief and two branch ginning factories left him little time for inspection. The American war had begun and the great rise in the value of cotton enabled even mixed and adulterated cotton to find a market. In 1862-63, exclusive of the cotton area in estate villages,

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¹ The members of the Commission were Messrs. G. Inverarity, M. H. Scott, R. Hannay, R. McIlwraith, G. F. Forbes, and C. Forjett. Three of the members were nominated by the Bombay Chamber of Commerce.

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363,174 acres were under American cotton, and 207,063 acres under local cotton, and in 1863-64, 323,535 acres were under American and 203,626 acres under local cotton. The local price of Dhárwár New Orleans rose from £14 (Rs. 140) the *khandi* in 1860 to £38 (Rs. 380) in 1863, and to £46 10s. (Rs. 465) in 1864, and every available patch was planted with cotton. In 1864-65 a bad season reduced the American cotton area to 280,230 acres and the local cotton area to 185,374 acres. Growers and dealers tried to supplement their deficient crop by mixing and false packing, and, as most of the inspector's time was again devoted to the factories, the people began to think that the Frauds Act was not to be enforced. The offices of superintendent of the factory and of inspector were separated. Early in 1865 Mr. G. Blackwell was appointed inspector. He began a vigorous inquiry, and though several of the prosecutions failed from want of proof of fraudulent intent, the dread of conviction greatly reduced the amount of adulteration. Efforts were also made to induce the landholders to give up mixing the two varieties of seed in the same field, and to pay more attention to the choice of good large seed. In 1865-66, there was a further fall in the area, to 160,046 acres under local and 261,943 acres under American cotton. This fall was probably due to the scarcity of fodder and grain caused by the failure of rain in 1864-65. In 1865-66 the rainfall was again far from favourable, and the outturn of most crops was poor. The inspector found it very difficult to prove the mixing at the gins fraudulent under the provisions of the Act. In this year large supplies of fresh seed were distributed, and did much to improve the quality of the New Orleans cotton.

In 1866-67 the area under American rose to 304,688 acres and under local cotton to 161,750 acres. Under the influence of the cotton inspectors, frauds and dirt-mixings were greatly checked. Still, in the opinion of Mr. Bulkley the inspector-in-chief of cotton, the working of the Act had brought to light a flaw in the provisions regarding fraudulent mixing. To be fraudulent, mixing must take place in cotton either offered for sale or offered for pressing. There were no presses in Dhárwár and the cotton was sold not in Dhárwár but in Bombay. So the inspector might see in a ginning yard a heap of local, a heap of American, and a third heap of seed to be added as a make-weight and yet fail to secure a conviction. One effect of the cotton famine in Lancashire caused by the American war was to give fresh importance to the question of improving the supply of Indian cotton. It was felt that no considerable results could be looked for unless specially trained men were employed and set apart for the special duty of improving cotton. In 1866-67 Mr. W. Shearer was sent out by the Secretary of State to undertake the charge of cotton experiments. In 1867-68 the area under American cotton fell to 300,399 acres and the area under local cotton rose to 181,485 acres. Mr. Shearer began his experiments on twelve acres of land near Dhárwár which were leased for five years. He carefully planted two kinds of local cotton, and the result promised fairly well. But he was ordered to Gujarát before the crop was picked and the cotton was sold before his return.

and no record kept. Mr. Blackwell the inspector found a great deal of false packing. He tried to persuade merchants to aid him in bringing the offenders to punishment, but failed, as the merchants though willing were afraid to offend the dealers. In 1868-69 the area under American cotton rose to 317,310 acres and under local cotton to 194,586 acres. Though both crops suffered from blight the outturn was fair. With the revival of American supplies the price of cotton fell. To make good the loss in price, the dealers weighted the cotton by adding dust and other refuse. These fraudulent mixers were fairly safe as with a little care they could destroy the cotton without breaking the letter of the law. Of several prosecutions, all of which were aggravated cases clearly within the spirit of the law, only one was successful. Mr. Shearer's farm of twelve acres near Dhárwár was given up and a larger farm of thirty acres was started at Kusvugal near Hubli. In 1868 two more cotton experiment superintendents, Messrs. Milne and Strachan, came from England and were placed for some time under Mr. Shearer. Mr. Shearer's experiments included sowings of Dhárwár American and local, and of Broach, Tinneveli, Tanjor, and Koimbatore. Except the local Dhárwár none of these yielded a good outturn.

In 1869-70 the area under American rose to 425,099 and of local to 222,116 acres. This great increase in American was mainly due to increased facilities for repairing the cleaning machinery. The sowing was late on account of heavy early rains, and the crop was much hurt by blight when the plants were nearly mature. About fifty tons of the best acclimatized seed were distributed in Karajgi, Navalgund, Ránebennur, and Ron, and about a ton of fresh American seed was distributed by Mr. Shearer. The acclimatized seed was willingly sown, but the people were afraid to risk the fresh American. Fresh American seed sown by Mr. Shearer thrived well. Two fraud cases were tried; but both failed. Mr. Shearer worked this year on a much larger scale than before. He had farms of 198 acres in Bankápur, Kusvugal, and Navalgund; and planted several varieties of cotton. The result was disappointing mainly owing to the badness of the season. In these experiments the late sown plants thrived better than those sown earlier. The object in dividing the experiments was to secure a fair average of soil and climate. In addition to this Mr. Shearer set apart a small piece of land close to his house at Kusvugal, as a nursery to study the habits of the different cotton plants, and to test the theories of crossing. In 1870-71 the area under American fell to 335,297 and under local to 195,304 acres. Up to the time of picking, the season was fair, then heavy rain fell and damaged the ripe crop. Frauds were rife, but there was no successful prosecution; and great complaints were made of the state of the saw-gins. Mr. Shearer continued his experiments in the same sub-divisions, but on fresh land. The land was ploughed with English ploughs and was afterwards stirred with an English grubber. He used both patent and native manure, but failed to discover any difference in the yield of cotton crops on manured land, and on unmanured land. These experiments were more successful than any of his former ones; the largest acre yield of clean cotton was 129 pounds. The people were

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so much pleased with the result of the sowing that they applied for seed. In 1871-72 the area under American cotton fell to 315,387 acres and the area under local cotton rose to 203,191. This season Mr. Shearer's experiments were limited to 110 acres, eighty at Kusvugal and thirty at Navalgund. Between excessive rain and cutting winds the season was unfavourable. At Kusvugal the selected seed American cotton was sown in three fields. Sowing was begun on the first and completed on the tenth of September. The crop was not large, the acre outturn of clean cotton averaging sixty-one pounds. At Navalgund two fields of fourteen and ten acres planted with local cotton yielded an acre outturn of sixty-two and twenty-one pounds of clean cotton, the remaining six acres were planted with acclimatized Broach which returned an acre yield of fifty-seven pounds of clean cotton. At Kusvugal Mr. Shearer did the greater part of his work with English tools, with the view of making native farmers acquainted with their use. The English tools did their work better than the native tools; and Mr. Shearer always offered the people such tools as he could spare. During his whole stay he was only thrice asked for their use. The native tools were effective when the under-soil was moist from rain, and it was only with moist under-soil that the cultivator worked. In 1872-73 the area under American cotton fell to 195,809 acres, and the area under local cotton rose to 318,448. Fraud, both in ginning and in packing was rife; of fourteen prosecutions eight were successful. Mr. Robertson the Collector thought that the Cotton Frauds Act was weak and that the Dhárwár trade required a much more stringent law. During 1872-73 a difficulty regarding continuing Mr. Shearer's pay out of the Cotton Improvement Funds stopped his experiments and seriously interfered with his arrangements. In this year the question was raised whether it was worth while trying to keep up the supply of American cotton. Would it not be as well to have the whole area under the local cotton? Many of the native dealers were of opinion that the local cotton could never be as valuable as the American cotton; one reason why so much local cotton was grown was that its seeds were a valuable cattle food. The cotton inspector contended that if the whole cotton area was given to local cotton there would be serious difficulty in getting it ginned. The markets for the two crops were distinct, and this division by reducing supplies tended to keep up the value of both. Finally the American was a more valuable crop than the local crop. The yield was larger, the price was higher, and the proportion of clean cotton to gross outturn was greater. Mr. Robertson endorsed this opinion: he thought the importance of the American variety could not be overrated.

In 1873-74 the area under American rose to 215,325 acres and the area under local fell to 268,169. The outturn was fair. Mr. Shearer gathered about 16,000 pounds of selected American seed which the Collector Mr. Robertson distributed in Gadag, Hubli, Navalgund, and Ron. It was arranged that similar distributions should be made every year. The system followed was to gather good seed from the best tracts and distribute it in the parts of the district where the Dhárwár-American had deteriorated. The plan was

excellent except that it was on too small a scale. Fraud was very troublesome and of twelve prosecutions only five succeeded. All the European merchants of the district joined with the inspector in pleading for an Act with stronger provisions, and in this they had the support of the Collector Mr. Robertson. In 1873 in the Government farm which was started near the villages of Lakmanhali and Navalur about five miles south of Dhárwár, the land was divided into seven plots and planted with American and local cotton. In the first season the acre yield of the American cotton varied from sixteen to seventy-five pounds of clean cotton, and of the local cotton from seventy to 154 pounds. In 1874-75 the area under American rose to 234,341 acres and the area under local cotton fell to 221,343 acres. Fraud was very rife, but by the exertions of the inspector Mr. Walton of thirty-six prosecutions, thirty-two were successful. Some of this season's cotton was ginned in the steam gins which had been lately started by the Kárwár company at Hubli. In this year (1874) Government appointed a Commission to inquire into the necessity for continuing the special law to suppress cotton frauds.¹ The majority of the Commission, after collecting a large amount of evidence, were of opinion that though it was not advisable to annul the Act it was advisable to place it in abeyance for a time. When the matter was referred to the Secretary of State the Bombay Government were directed to prepare a fresh Act with the object of remedying the defects of the existing measure. Heavy and unseasonable rain made 1874-75 an unsuccessful cotton season at the Government farm. The acre yield of local Dhárwár and Broach was only forty-five pounds of clean cotton. The fresh American seed sprouted well, but soon after died. The acclimatized American promised well but suffered from blight; the acre outturn was fifty-seven pounds of clean cotton. To test the theory of the crossing of the two varieties one plot was sown with a mixture of local and American seed. The plot promised well, but about two-thirds of the bolls were spoiled by blight. A plot of New Orleans sown at the end of August yielded only thirty-five pounds of clean cotton the acre. Government were disappointed with the results; such repeated failures year after year must end in the closing of the farm.

In 1875-76 the area under American rose to 336,235 and under local cotton to 232,630 acres. A steam-ginning factory was opened at Gadag and much cotton was ginned in steam-gins. In consequence of the last year's successful prosecutions there was a considerable improvement in both varieties of Dhárwár cotton, though some badly adulterated cotton, ginned and packed in the Nizám's country, injured the name of Dhárwár cotton. Of fifty-eight prosecutions fifty-three were successful, but of the convictions two were afterwards reversed on appeal to the High Court in Bombay. The cotton experiments on the Government farm were

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¹ The members of the 1874 Commission were the Honourable A. Rogers, President, and the Honourable Messrs. E. W. Ravenscroft and Náráyan Vāsudev, and Messrs. H. P. LeMesurier and E. M. Fogo, members.

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fairly successful. Owing to the failure of the usual October and November rain the cotton crop was nowhere good and this failure of rain was accompanied by so blighting an east wind that Mr. Shearer thought it must be poisonous. The acre yield of clean American cotton in well prepared good black soil was thirty-four pounds. The acre outturn of clean local cotton in equally good soil was only twenty pounds. One plot of ground was sown with American cotton with sunflowers scattered here and there. The cotton plants grew well till November and were then caught by blight. The superintendent tried every means, including watering, to save the crop; with all his efforts he only succeeded in keeping the leaves a little greener than those of the plants in the neighbouring fields. Another three-acre plot was divided between selected American seed and freshly imported American seed. The land was well manured with slaughter-house refuse and poudrette in separate parts, but with no variety in result. The crop was attacked by blight and the acre outturn was nineteen pounds of clean cotton. A quantity of dissolved Peruvian guano, costing in Bombay £17 10s. (Rs. 175) a ton, was freely applied to cotton, but apparently without any improving effect. The guano was applied at the rate of three hundredweights the acre on a field of local cotton. So long as rain lasted the guanoed patch grew specially freely. When the dry weather set in this difference disappeared, and the outturn proved no larger than that of the neighbouring fields. The saw-gins were falling into disrepair and their state was unsatisfactory.

In the famine year of 1876-77 the area under American cotton fell to 44,024 and under local cotton to 99,830 acres or little more than one-fourth of the average area of the five previous years. The large number of convictions in the previous year was followed by a great improvement in the state of the cotton. The dealers never remembered such clean cotton. At the Navalur farm Mr. Shearer sowed American fresh and acclimatized, and selected Broach. In addition to the experiments at the Government farm Messrs. Robertson Brothers & Co. planted about fifteen acres with Hinganghát seed in three fields of about five acres each. Their aim was to try Hinganghát seed both for early and for late sowing. The first field had no manure and was sown about the 15th of August; the second field had twenty carts of common village manure and was sown about the 20th August; and the third field had thirty carts of common village manure and was sown about the 25th of August. Messrs. Robertson & Co. arranged with the landholders to make good whatever the outturn of the Hinganghát fields fell short of the outturn of neighbouring fields of local or of American-Dhárwár. At the same time any return over that of neighbouring fields was to go to the landholder. The complete failure of the late rains made these arrangements useless. So complete was the failure of the cotton crop that Messrs. Chrystal & Co. in Gadag did not press a single bale. Of four prosecutions two were successful. The crop was very small and what came to market was clean. In 1877-78 the area under American rose to 128,277 acres and the area under local cotton to 277,300 acres. There was no local case of mixing or false

packing, but much seriously adulterated and falsely packed cotton came from the Nizám's country and was sold on the coast under the name of Dhárwár saw-ginned cotton. Messrs. Robertson & Co. continued their experiments in Hinganghát. The seed was sown in July and in November the plants with flowers and some with bolls promised well. Heavy rains in December spoiled the crop reducing the outturn of nineteen acres to three bales of clean cotton. One of the chief objects of Messrs. Robertson & Co.'s experiments was to introduce an early cotton into Dhárwár. The result was disappointing. The plants sown in July did not ripen earlier than the plants sown in September. It seemed as if the plants were unable to ripen so long as the ground remained damp and the weather continued cloudy. Mr. Campbell, the manager of the Kárwár Cotton Company, made an experiment with Egyptian Bunnia cotton. Mr. Campbell divided his field into two parts: one which he worked in the same way as the people grew American cotton, and the other part which he watered. The seed was sown on the first of September, the first watering was given on the 17th of November, and watering was continued at intervals until the beginning of May. Mr. Campbell found no difference between the watered plants and the unwatered plants. The number of watered bolls was small, and the staple was good. But the colour was so bad that it looked as if it had been stained by damp. Five hundred pounds of fresh American seed were received from Government for distribution. In 1878-79 the area under American cotton rose to 246,210 acres and under local cotton fell to 233,280 acres. Of eight cotton fraud prosecutions six were successful. As in former years the passing as Dhárwár American of cotton adulterated in neighbouring states was a serious evil. In September 1879 the Government of India recommended that all special legislation for the suppression of cotton frauds should cease. The Secretary of State did not agree with the view held by the Government of India. In 1879-80 there was a marked fall in American and rise in local cotton. The American area fell to 141,726 acres and the local area rose to 331,465 acres. On the 4th of March 1880, the Secretary of State sanctioned the proposals that had been made in 1879 by the Government of India, and desired the Bombay Government to do away with the special cotton fraud prevention establishment. According to Mr. Walton, the opinion of the local European agents and native merchants was opposed to the giving up of Government efforts to check fraud. According to Mr. P. Chrystal, a Bombay merchant who is well acquainted with the Belgaum and Dhárwár cotton trade, the Bombay dealers and merchants in American Dhárwár and Kumta cotton think (1883) that the Cotton Frauds Act failed to stop adulteration in the Bombay Karnátak. Mr. Chrystal thinks that since the Act has been stopped, there has been no noticeable increase in adulteration. The American Dhárwár has declined in staple and lost its silkiness, but this he thinks is due not to more mixing but to deterioration in the American seed. In 1880-81 the area under American cotton fell to 77,121, and the area under local cotton rose to 439,251. In 1881-82 the area under American cotton rose to 138,790, and the area under local cotton fell to 395,396 acres.

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In 1882-83, the area under American cotton further rose to 145,397, and the area under local cotton fell to 375,070 acres.

The following table gives the areas under American and local cotton during the forty-one years ending 1882-83 :

Dhárwār Cotton Area, 1842-1883.¹

YEAR.	American.	Local.	Total.	YEAR.	American.	Local.	Total.
	Acres.	Acres.	Acres.		Acres.	Acres.	Acres.
1842-43	27	184,237	184,264	1863-64	323,535	203,626	527,161
1843-44	545	178,411	178,956	1864-65	280,230	185,374	465,604
1844-45	2749	182,437	185,186	1865-66	261,943	160,046	421,989
1845-46	11,176	164,591	175,767	1866-67	304,688	161,750	466,438
1846-47	22,331	167,592	189,923	1867-68	300,399	181,485	481,884
1847-48	20,502	179,229	199,731	1868-69	317,310	194,586	511,896
1848-49	3351	201,578	204,929	1869-70	423,099	222,116	645,215
1849-50	15,573	225,685	241,258	1870-71	335,297	195,304	530,601
1850-51	31,068	223,315	254,383	1871-72	315,387	203,191	518,578
1851-52	42,647	221,676	264,323	1872-73	195,809	318,448	514,257
1852-53	28,010	251,114	279,124	1873-74	215,325	228,169	443,494
1853-54	41,403	252,006	293,409	1874-75	234,341	221,343	455,684
1854-55	63,298	210,260	273,559	1875-76	336,235	232,630	568,865
1855-56	66,514	202,843	269,357	1876-77	44,024	99,330	143,354
1856-57	108,207	196,931	305,138	1877-78	128,277	277,300	405,577
1857-58	130,880	252,850	383,730	1878-79	246,210	233,280	479,490
1858-59	124,752	214,993	339,745	1879-80	141,726	331,465	473,191
1859-60	191,281	230,665	421,946	1880-81	77,121	439,251	516,372
1860-61	191,026	234,452	425,478	1881-82	138,790	395,396	534,186
1861-62	214,310	200,491	414,801	1882-83	145,397	375,070	520,467
1862-63	363,174	207,063	570,237				

GARDENS.

GARDENS are found chiefly in Bankápur, Hángal, Karajgi, Kod, and Ránebennur where irrigation is abundant and easy. The best gardens are below the large reservoirs. They are fenced with guava, lime, and other fruit trees, and contain sugarcane, cocoa and betel palms, and betel vine. During the greater part of most years the gardens draw a plentiful supply of water from the reservoir. The supply is also helped by the soaking of water through the pond bottom into the gardens. To help this soaking holes are dug a few feet deep, and, if the reservoir fails, the water is scooped out of the holes by shallow baskets called *gudás* which are swung through the well and carry a basket full of water to a level high enough to let it run into all the small channels. Minor garden crops and watered dry crops as well as rice are often grown in the gardens as change crops after sugarcane or after the betel vine is removed, to give the soil fresh vigour. Some gardens with a poor water-supply grow only minor crops. Except in parts of Kod the better garden crops are grown with much care and labour. In the slovenly gardens of Kod, in one corner betel vines are mixed with a plantation of young betel palms. Between the rows of betel vines and perhaps in other parts of the garden are a few plantain trees, and, scattered about with little regard to regular planting are thirty to sixty cocoa palms. The rest of the garden is altogether untilled, or is perhaps sown with crops which would grow nearly as well in a field as in a garden, but which have the merit of hardiness and of requiring little care. The chief garden crops are the betel vine, plantain, betel palm, cocoa palm, and mulberry.

¹ The figures are for the district of Dhárwār including alienated lands in Government villages and native state lands mixed with Government lands.

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Betel Vine.

The Betel Vine *elebulle* (K.) or *pán* (M.) *Piper betel*, a perennial, is the chief garden produce. It is planted by cuttings. As it is a creeper, long thin quick-growing trees generally *nagis*, *halivals*, and *chavgachis* are set close beside it for the vine to train on. The vine wants manure three or four times during the year, and, to succeed well, must be watered every eighth day and still oftener during the first year. The vine begins to bear leaves in the third year and yields a crop every third month. An acre of land contains upwards of two thousand plants. Leaves are gathered for four, five, six, and sometimes seven years when the vines die and are dug up, the leaves of the trees on which they have been trained affording vegetable manure to young plantains and their wood being used for fuel. After a crop of betel vine the garden is deeply dug all over. According to some accounts it lies fallow for a whole year and is then planted with sugarcane; after the sugarcane it enjoys another year of fallow, when the betel vine is again planted or instead of it plantains. According to others sugarcane is planted immediately after the ground has been cleared of the betel vine and has been well dug, ploughed, and levelled; then one year of fallow succeeds the cane, and the fallow is followed by plantains or betel vine, or, before these, by a crop of chillies or a dry-crop. Most of the betel leaves are used in the district, the rest are sent to Belgaum. Except to men of means the betel vine is not a paying crop as the heavy expense of two years of planting, manuring and watering has to be met before there is any return.

Plantains *bálegidu* (K.) or *kel* (M.) *Musa sapientum* yield only one crop. The trees are then cut down, but new shoots spring from the roots which are transplanted and set in a small pit with manure earth and dry leaves and well watered every eighth day. They are planted in lines four to five feet apart, bear fruit in the second year, and are then cut down. In some cases plantains are followed by a year's rest and the year's rest by betel-vine.

Plantains.

Betel Palms¹ *adkigidu* (K.) or *supári* (M.) *Areca catechu* are generally scattered among the betel vines. When planted by themselves, an acre of land holds over six hundred palms. The palm appears above ground six months after the nut has been planted. If cared for and freely watered, at first twice and afterwards once a month, the betel palm bears fruit in eight years; otherwise it does not begin to bear for ten or even twelve years. It continues to bear yearly for fifty to seventy-five years. The nuts are taken from the tree between October and December.

Betel Palms.

Cocoa Palms *tenguigidu* (K.) *náriel* (M.) *Cocos nucifera* bear when ten to twenty years old. If manured and watered, at first twice and afterwards once a month, they generally bear in their twelfth year and continue bearing nearly a hundred years.

Cocoa Palms.

The Mulberry *kila* (K.) *tut* (M.) *Morus indica* is found in many native gardens grown sometimes as a hedge plant and sometimes for their small and pleasant fruit. They seem to have been introduced

Mulberry.

¹ Fuller details are given in the Kánara Statistical Account, Bombay Gazetteer, XV. Part II. 7-9.

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Mulberry.

some sixty years ago when the first attempt was made to grow silk.¹ In 1823 Mr. Baber the Collector introduced worms from Maisur into the Bombay Karnatak, first at the Dhárwár jail, and afterwards among a few Musalmáns near Dhárwár, Hubli, and other towns. These persons were granted seven years' leases and were given advances of cash. The attempt to grow silk was so far successful that in 1827 a package of Dhárwár silk was sent to England. The ship which carried it was wrecked and the sample damaged. The Court of Directors reported that had the parcel been in a sound state the raw silk would have been sold at the rate of twelve shillings a pound. In 1833 Dr. Lush, who at that time was in charge of the Dhárwár cotton experiments, reported that the people among whom the worms were distributed had each one or two acres of land under the mulberry. The outturn was a few *mans* of silk for local use which in the Hubli market sold at 14s. to 16s. the pound (Rs. 3½-4 the *ser*). In 1842 about four hundred pounds of a very inferior silk was made. In 1843 at Dhárwár there were 200 mulberry trees and 25,000 bushes, besides 10,820 bushes in the jail garden. About 272 pounds of silk worth £50 (Rs. 500) were made by the people and 144 pounds worth £36 (Rs. 360) were made by the prisoners. In 1848 after inquiry the attempts to grow the mulberry with a view of establishing a silk industry were stopped. In 1865 silk experiments were revived at Dhárwár by Dr. Mackenzie the jail superintendent. In the sixteen months ending September 1869 the jail produced nearly eleven pounds of raw silk worth about 16s. (Rs. 8) a pound. A comparison of the results of the last six with the first ten months of the period showed marked improvement in the weight of the cocoons and an advance from 6·7 to 8·7 in the proportion of silk to total weight. Dr. Mackenzie thought the improvement was due to the greater attention which had been paid to the food of the worms, to regularity in feeding them, to the airiness and brightness of their rooms, and to the efforts made to prevent the temperature varying more than from 85° to 90°. The worms were fed on mulberry bushes cut down at the beginning of each monsoon and not allowed to grow more than three or four feet high. The worm bred has not been identified. From Dr. Mackenzie's description it seems to have been one of the Bengal multivoltines; its total course is given at 55½ days. In 1872 besides the jail experiment there was a small mulberry plantation which turned out a fair supply of cocoons. During 1873-74 the mulberry plants thrived well without watering, and though not a drop of rain fell from the 8th of November 1873 to the beginning of April 1874, the bushes continued without watering fresh and healthy and threw out a constant supply of leaves enough to feed a considerable number of silk worms. In 1873 samples of raw silk, the result of Dr. Mackenzie's trial, were sent to experts in Glasgow, London, and France. Their opinions and suggestions were closely alike. The thread was bright in colour and had good nerve; it had been much spoiled by bad reeling. The

¹ Silk in India by Mr. J. Geoghegan, Under Secretary to the Government of India (1872), 27-41.

highest value of the sample was 12s. (Rs. 6) the pound ; had it been properly reeled it would have been worth £1 4s. to £1 5s. (Rs. 12-12½) the pound. The experts considered that the sample showed that Bombay was in a better position for growing silk than Calcutta. In April 1874, Dr. Mackenzie, while noticing these favourable opinions, wrote to the Bombay Government that successful silk growing in Dhárwár would depend entirely on European supervision, and that he found on inquiry that, even at the highest rates fixed by the European experts, there would always be a demand in the Bombay Presidency, in Bángalur, and elsewhere for such silk without the trouble and expense of sending the produce to Europe. The Bombay Government considered that the climate and soil of Dhárwár were well suited for silk growing and that Dr. Mackenzie's experiments gave a fair hope of success. They directed him to continue his operations with jail labour and to plant a plot outside the jail with mulberry, and granted him £50 (Rs. 500) for sundry expenses connected with the trial.¹ In 1876 experiments were made to rear the tasar silk-worm, but owing to the small amount of silk cocoons obtained no important result was noted. Cotton has for the most part driven out silk, and, in Mr. Robertson's opinion, water is too far below the surface for irrigated mulberry tillage to pay.

In May 1873 Mr. E. P. Robertson, C.S., then Collector of Dhárwár, asked the sanction of Government to start an experimental farm near the villages of Navalur and Lakhmanhalli about five miles south of Dhárwár. The farm was to be started on about seventy-seven acres and to be gradually extended to two hundred acres. Government gave their sanction and Mr. Shearer who since 1866 had conducted the cotton experiments in Dhárwár was appointed its superintendent. The land was obtained with some difficulty, and late in the season Mr. Shearer began work in 29½ acres of land divided into seven plots. The land was broken with a plough and grubber that had been sent out by the late Marquis of Tweeddale through the Secretary of State. This machine was based on the wheel and lever principle. It had been planned by and made under the supervision of the late Marquis of Tweeddale when Governor of Madras (1842-1848). It was worked with one or two pairs of bullocks and though as light to work for the same depth as the country plough it had several advantages. When once set on a straight furrow it needed no holding. It turned out a furrow each time while the country plough merely displaces the soil on each side and generally leaves a ridge altogether unploughed ; it could be used in soil moderately dry and could be regulated to depth and breadth to suit the bullock's strength, while the country plough cannot be worked in a too moist and heavy soil. The English plough fell into disuse because its repair required more skilled labour than the ordinary field tools. During the season the farm was increased to 103 acres. The cotton crop was a success, the acre yield varying from sixteen to seventy-five pounds of clean American, and from seventy to 154 pounds of clean local cotton. Want of rain

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GARDENS.

*Mulberry.*EXPERIMENTAL
FARM.

¹ Memorandum on Silk in India by L. Liotard, Department of Revenue and Agriculture, Government of India, 1883.

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was the main cause of some of the smallest yields of American cotton. Besides cotton, a fine crop of sugarcane was obtained where the native growers had repeatedly failed, and successful attempts were made to get a market oil from sunflower. The total cost during 1874-75 amounted to £165 (Rs. 1650) and the receipts to £80 (Rs. 800), or a working loss of £85 (Rs. 850). In 1875-76 the area of the farm was raised to 109 acres all acquired at a cost of £760 (Rs. 7600) and the number of plots was raised from seven to nine. These nine plots were sown with food-grains, greens, cotton, safflower, and sunflower. The rains set in as usual and the crops promised well till August when the weather became unusually dry. Occasional showers helped the crops till October when cutting winds joined with the drought destroyed all hope of a good yield. Still some crops did fairly, but the failure of the cotton and to great extent of the wheat and gram reduced the outturn to 16s. (Rs. 8) the acre. Peruvian guano was applied to half an acre sown with potatoes and the result was a yield of nearly one ton which realized £5 16s. (Rs. 58). The total working charges including assessment were £179 (Rs. 1790) and the total net loss was £85 (Rs. 850). In 1876-77, the famine year, the wheat crop, which is generally sown after the first burst of the north-east monsoon in October, was very hurriedly put in, as it was feared that, by delay, the scanty supply of moisture in the ground might be lost. In the neighbourhood of Navalur the seed came up well, but the easterly winds dried up the half-moistened soil. The wheat straw grew stunted and weak, and the grain was very light, some fields barely yielding as much as the seed sown. Cotton sowing began about the middle of August but the crop was never promising. The sowings of American cotton in three fields kept remarkably free from blight but they were weak and stunted. The yield from two of the fields was extremely light; in fact the cotton crop of the village was almost a failure. The income amounted to £150 8s. (Rs. 1504). In consequence of these repeated failures the farm was closed from the 1st of October 1877.

FAMINES.

1396.

1423.

1424.

1471.

Blights are rare and never so widespread as to affect the general harvest. Cotton occasionally suffers from mildew, and the grain crops are often damaged by insects, rats, and locusts. The earliest recorded failure of rain in the whole country south of the Narbada is the great Durga Devi famine, which began in 1396 and is said to have lasted nearly twelve years. This famine was caused by the total want of seasonable rain. Almost no revenue was recovered and a large proportion of the people died.¹ In 1423 no rain fell and there was a grievous famine throughout the Deccan and the Karnatak; multitudes of cattle died from want of water. Ahmad Sháh Bahmani (1419-1431) increased the pay of his troops and opened public stores of grain for the use of the poor. In 1424 there was again a failure of rain and the country was much disturbed.² The years 1471 and 1473 are described as seasons of exceptional distress. No rain fell and no crops were sown for two years. Many died and many left the country. In the third year, when rain at last fell, scarcely

¹ Grant Duff's Maráthás, 26.² Briggs' Ferishta, II. 405.

any one was left to till the land.¹ In 1790 the march of the Maráthás under Parashurám Bháu through Dhárwár to Maisur was accompanied by such devastation, that on its return from Maisur the victorious army almost perished from want of food. In 1791-92 there was a terrible famine, the result of a series of bad years heightened by the depredations caused by the Maráthás under Parashurám Bháu. The distress seems to have been great in Hubli, Dambal, and Kalghatgi, where the people were reduced to feeding on leaves and berries, and women and children were sold. In Dambal the rains failed for twelve years and for three years there was no tillage. From the number of unburied dead the famine is remembered as *Dogi Bára* or the Skull Famine. The distressed were said to have been relieved by the rich. Beyond seizing some stores of grain at Hubli the Peshwa's government seem to have done nothing. At Dambal grain was sold at two and a half pounds the rupee.² In 1791 between the 23rd of April and the 6th of May, the rupee price of rice was six pounds (3 *pakka shers*) at Kárur, Ránebennur, Motibennur, Háveri, Sháhánur, Kailkunda, Hubli, and Dhárwár; of gram six pounds (3 *pakka shers*) at Kárur, Motibennur, Hubli, and Dhárwár, and eight pounds (4 *pakka shers*) at Háveri, Sháhánur and Kailkunda; and of Indian millet eight pounds (4 *pakka shers*) at Kárur, Ránebennur, Motibennur, Háveri, Hubli and Dhárwár, and ten pounds (5 *pakka shers*) at Sháhánur and Kailkunda.³ The 1802-3 famine was not so much due to the irregularity of the season as to the ravages of war. The season was a fair one and the harvest would have been good but for the disturbed state of the country which prevented much land being sown and for the ruin caused by Pendhári ravages. The famine lasted for a year and the distress was deepened by large numbers of starving people pouring into the district from Pandharpur and Bijápur. On their way through Bijápur people could find neither food nor water. Their state on reaching Dhárwár was deplorable, and, without either shelter or food, they laid themselves down and died in numbers among the bushes which then grew round the fort. From the numbers of destitute who came into the district and from the widespread distress, this famine is remembered as *Byán Bára* or the Terrible Famine. Thousands of dead strewed the roads. Probably from the number of unburied bones, but, according to the local story because in their agony the dying beat their heads together, this, like the 1791-92 famine, was called *Dogi Bára* or the Skull Famine. Grain is said to have sold at 17½ to 21 pounds (5-6 *sers*) the rupee. In Hubli the rich headed by Chintámanráo Patvardhan helped the poor. The Peshwa's government seem to have afforded no relief.⁴ Between 1801 and 1832 two partial famines are recorded, in 1814 and in 1824. The 1814 famine is known as the *Bisaghi Bára* or Drought Famine. It is said to have been deepened by the disturbed state of the country, and apparently was serious only in Dambal. It lasted two months during which grain sold at twenty-four pounds (7 *shers*) the rupee. In 1824

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1791.

1802-3.

1814.

¹ Briggs' Ferishta, II. 494.² Col. Etheridge's Past Famines, 105.³ Moor's Narrative of Captain Little's Detachment, 232.⁴ Colonel Etheridge's Past Famines, 106-107.

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FAMINES.
1832.

another short two months famine is recorded, when grain sold at forty-two pounds (12 *shers*) the rupee. It is attributed to failure of rain and seems to have extended to Belgaum. In 1832 local failure of rain and the immigration of destitute people from the country north of the Krishna caused great scarcity all over the district. The price of grain varied from 24½ pounds (7 *shers*) in Hubli to 31½ pounds (9 *shers*) in Dambal, and in Dambal some of the poorest were reduced to eating grass. The rich in Hubli, headed by Apparáo Lokhande, subscribed for the relief of the poor, and Government remitted the grain tolls. Mr. Elliot, the Collector, issued an order forbidding forestalling and regrating, and requiring the dealers to bring their grain into the market. Ponds and other useful works were begun to provide labour for the poor.

1866.

In 1866 the district was again visited by famine, the result of a succession of bad seasons. Though the rains set in late a fair harvest was looked for until August, when rain held off and grain became both dear and scarce. People who had stores of grain were unwilling to part with them. The distress was most severe in Navalgund, Ron, and Dambal. In Dambal the distress was not the result of one year's bad harvest, but of a continual failure of crops for some three or four years. Many were reduced to beggary and still more left their homes in search of food, many with the object of returning when better times came, and a few with the object of never returning. On the other hand, there was a large influx of people from Belgaum, Bijápur, and Belári. At the end of September heavy and continued rain saved the crops. To afford relief to the sufferers works not requiring skilled labour were begun in the Dhárwár, Navalgund, Ron, and Gadag sub-divisions. A special famine-works grant of £4000 (Rs. 40,000) was made by Government from local funds, and £350 (Rs. 3500) from Imperial funds. A special grant of £5000 (Rs. 50,000) was also given for the improvement of the high road from Tegur by Dhárwár to Harihar, and an advance of £1600 (Rs. 16,000) was promised to the Dhárwár municipality to improve a large reservoir in the suburbs of the town. Considerable numbers of the poor thus found employment for several months, until the harvest was gathered, which the timely late rains of September and October saved. The old and infirm, who could not work, were fed by private charity at Dhárwár, Hubli, Navalgund, Nargund, Annigeri, Basápur, Bhadrapur, Gadag, Dambal, Karajgi, Háveri, Devihosur, and Ron.¹ By December distress had disappeared. The harvest, especially the grain harvest, was the best reaped for several seasons. At Dhárwár the rupee price of Indian millet fell from twenty-one in September to seventy-three pounds in December (6-21 *shers*); of millet from eighteen to sixty-eight pounds (5¼ - 19½ *shers*); and of poor rice from twenty-one to thirty-nine pounds (6 - 11¼ *shers*).

1876-77.

The scanty and still more the ill-timed rainfall of 1876, 13·81 inches compared with an average of 26·39, led to failure of crops and distress

¹ Colonel Etheridge's Past Famines, 105-116.

amounting to famine over about two-thirds of the district.¹ The north and east suffered the most. In addition to the failure of the early crops, September and October (1876) passed with only a few showers, and very little of the late crops were sown. With high grain prices, Indian millet at $16\frac{1}{2}$ instead of forty-three pounds, and with little demand for field work, numbers of the poorer classes fell into distress. The need for Government help began early in September, when relief works were opened and paid for out of local funds. In the hot months of 1877 (March to June), with rising prices, the distress grew keener and more widespread. The failure of rain in July and August caused great anxiety and suffering, which were removed by the timely and copious rainfall of September and October. The condition of the people rapidly improved, and by the end of October distress had disappeared. At the close of November the demand for special Government help had ceased.

The following details show, month by month, the state of the district and the measures taken to relieve the destitute. In September 1876 as the rain still held off, except in the west and in lands which could be watered, the early crops perished. Grain prices rose, *javári* being sold at Ron, about the middle of the month, at thirty-two pounds the rupee. Water was growing scarce and fodder was difficult to procure. Owing to the want of rain the fields could not be prepared for the cold-weather crops, and, early in the month, the demand for work became general, and many of the poorer classes left the district. To give employment to the destitute, the digging of the Navalgund lake, and the making of the Dambal-Hesrur road, were started. About the close of the month, a fall of rain, 2·9 inches in Dhárwár, 2·14 in Navalgund, 2·5 in Kod, and 1·5 in Karajgi, did much good to what scanty early crops were standing. Elsewhere, though the fall was lighter, the people were encouraged to sow late crops, and drinking water became available in many places where it was urgently wanted. In spite of this relief, the demand for employment continued general. October passed with only a few showers. In Ron and Dhárwár, where the fall was good, late crops were sown, but the early crops everywhere grew worse, and cotton, where it was sown, was fast perishing. *Jvári* prices rose to about thirty pounds the rupee, and in Dhárwár, Karajgi, and Gadag many dealers refused to sell. Besides the want of grain, there was in some places great scarcity of drinking water and fodder. Local fund works gave employment to many of the destitute, and others, especially in Ránebennur and Gadag, were supported by the well-to-do. On the 17th, Government placed a sum of £2500 (Rs. 25,000) at the Collector's disposal for charitable relief. In November little rain fell, and there was no improvement in the crops. People took their cattle and left in large numbers for the Kánara forests. There was great suffering especially in Ron where many villages were deserted. Fodder and water were scarce, and, especially in the north, large numbers of cattle died. In spite of grain imports from

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¹ The estimate was in area 3000 square miles of a total of 4564, and in population 530,000 out of 988,037.

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Sholápur, *javári* rose from thirty to $13\frac{1}{2}$ pounds. And, though the harvesting of the early crops in the western sub-divisions gave a good deal of employment, the daily number on relief works rose from 4000 to 21,361. Of 10,005, the average daily number for the month, 8210 were able-bodied, expected to do a full day's work and superintended by ordinary public works officers, and 1795 were aged or feeble expected to do two-thirds of a day's work and superintended by *mámlatdárs* and assistant collectors.¹ December passed without rain and with no change in crop prospects. Harvest work in the west was nearly over, and, though some were coming back disabled by the climate, people and cattle continued to move in large numbers to the west of the district and to the Kánara forests. Fodder rose in price and in Navalgund was very scarce. Grain was imported in large quantities, the chief difficulty being the cost of carriage, cart rates between Kárwár and Dhárwár having risen from 14s. (Rs. 7) to £1 2s. (Rs. 11). The rupee price of *javári* fell from fifteen pounds at the beginning of the month to nineteen pounds about the close. Late in the month cholera broke out in four of the western sub-divisions. The numbers of the destitute considerably increased, on public works from 8210 to 19,432, against a fall on civil works from 1796 to 1011.

1877.

In January there was no rain and no change in crop prospects. Many were returning unable to stand the climate, but the migration of people and cattle to the Kánara forests and to the western sub-divisions still went on. The importation of grain continued, *javári* keeping fairly steady at eighteen pounds the rupee. In Ron, Gadag, and Navalgund fodder was scarce and people were bringing it from the Nizám's country. In the north the people suffered most from want of water. Cart rates from Kárwár to Dhárwár, after rising early in the month to £1 7s. (Rs. 13½), fell about the end to £1 (Rs. 10), and, to help the traffic, wells were dug along some of the grain trade routes. The numbers on relief works rose, on public works from 19,432 to 30,396, against a fall on civil works from 1011 to 792. There were 184 persons on charitable relief. February passed without rain and with no change in crop prospects. There was much movement among the people. Upwards of 20,000 passed west, while many, some of them belonging to Bijápur, came back from Kánara and Belári. In spite of large grain importations, *javári* rose from $18\frac{1}{2}$ to $17\frac{1}{2}$ pounds the rupee. Fodder was extremely scarce. In parts of Gadag cattle were fed on *nimb* tree leaves, and large quantities of rice straw were brought from Kánara. Cholera continued prevalent. The numbers on public works fell from 30,396 to 26,973, against a rise on civil works from 792 to 1481; on charitable relief they rose from 184 to 257. The fall on public works and the rise on civil works was because the people left the public works owing to cholera, and,

¹ The rates of wages originally fixed for the workers were, for a man 3d. (2 as.) a day, for a woman 2½d. (1½ as.), and for a boy or girl 1½d. (1 a.) About the middle of November a sliding scale was introduced, which provided that, when prices rose over sixteen pounds the rupee, the money rate should vary with the price of grain, and that a man should always receive the price of one pound of grain in addition to one *anna*.

losing condition from want of food, had to be taken into relief kitchens and on to civil works. On the 14th, to help the grain traffic, grass was brought to Gadag at Government expense. In March no rain fell. Many immigrants from Bijápur and elsewhere left the district, and emigrants to the Kánara forests came back with their cattle. About the end of the month cart rates between Kárwár and Dhárwár rose to £1 6s. (Rs. 13). This greatly crippled the grain trade and the rupee price of *javári* rose from 18½ to 16½ pounds. Cholera was prevalent and increasing. The numbers of the destitute rose, on public works from 26,973 to 29,712, on civil works from 1481 to 2385, and on charitable relief from 257 to 767. During the latter part of April there was an average rainfall over the district of 2·01 inches. People continued to move about in large numbers. Some of them were strangers from Belári, Bijápur, and Bángalur; others were Dhárwár people on their way back from the Kánara forests. Ploughing was everywhere in progress. In some parts of Dhárwár, Karajgi, and Ránebennur, *baragu* Panicum miliaceum, *navani* Panicum italicum, *sáve* Panicum miliare, and other fast-growing crops were sown. For a time the cart rates from Kánara to Dhárwár fell to £1 4s. (Rs. 12). Soon after, as the Dhárwár bullocks were engaged in field work, carriage was difficult to get, and cart-hire from Dhárwár to Kárwár rose to £1 12s. (Rs. 16), and further checked the import of grain. The rupee price of *javári* rose from sixteen pounds at the beginning to fifteen pounds about the close of the month. Cholera, though very severe in Kalghatgi, was decreasing. The immigrants found employment in large numbers on the relief works. Relief houses, where the infirm poor were fed twice a day, were opened over the greater part of the district. The numbers on relief rose, on public works from 29,712 to 38,999, on civil works from 2385 to 3003, and on charitable relief from 767 to 1989. On the 24th, a further sum of £1000 (Rs. 10,000) was placed at the Collector's disposal for charitable relief. In May a good deal of rain fell. Except in the east and north, sowing operations went on rapidly. In the west the *baragu* and other quick-growing crops, which had been sown in April, were in good condition. In Dhárwár, Kalghatgi, Bankápur, and Hángal, rice, and at Mundárgi in Gadag *bárgi* and *javári* were being sown. People from Bijápur and the eastern sub-divisions were moving west, tempted by the cheaper rate of grain and the better supply of water; others were coming into the south of the district from Belári and Maisur. In the red soil districts green grass had sprung up. But in the black soils fodder was still rising in price, and no fodder but leaves and very old straw was available. Cart-rates from Kárwár to Dhárwár rose to £2 (Rs. 20), and grain importations were very small. The rupee price of *javári* rose from fifteen to fourteen pounds. The people supplemented their supply of grain by tamarind seeds and various edible herbs, which were largely sold in the markets. Cholera continued prevalent, but was decreasing. The numbers on relief rose, on public works from 38,999 to 50,598, and on charitable relief from 1989 to 3088. On civil works there was a fall from 3003 to 2371.

In June there was an average fall of about 5·11 inches of rain. Large numbers returned to their homes in Bijápur, Belgaum,

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Sátára, Belári, Maisur, and the Nizám's country. The sowing of the early crops was general except in some parts of Ron and Navalgund, where but little rain had fallen. The harvesting of the quick-growing crops was begun in Bankápur, Karajgi, and Ránebennur. At Mundárgi and in the western sub-divisions, the poor were earning a little by bringing green grass to market. Cart-rates from Kárwár to Dhárwár, after rising in the beginning of the month to £4 (Rs. 40), fell, about the close, to £3 4s. (Rs. 32).¹ So high were the rates that importation was almost at a stand. *Jvári* prices rose from 12½ to 10¾ pounds the rupee. The numbers on relief rose, on public works from 50,598 to 53,851, on civil works from 2371 to 3469, and on charitable relief from 3088 to 3300. July passed with only a few showers, chiefly in the west. The early crops were everywhere withering and sowing operations kept back. In Hubli, Bankápur, Ránebennur, Karajgi, and Kod the quick-growing crops were harvested. People again began to move from the east westwards. Cart-rates from Kárwár to Dhárwár rose at the beginning of the month to £4 16s. (Rs. 48), the high rates seriously interfering with grain importation. Later on men were employed to draw carts at the rate of 10s. (Rs. 5) for each bag of grain brought from the coast. This competition was most useful, and cart-rates fell to £3 4s. (Rs. 32).² Still *jvári* prices rose from ten pounds at the beginning of the month to 8½ pounds at the close. The numbers on relief fell considerably, on public works from 53,851 to 21,532, on civil works from 3469 to 2581, and on charitable relief from 3300 to 1487. This fall was probably due partly to the people's unwillingness to camp out during the rain, the huts provided being hardly ever watertight, and partly to the hope of regular field work. In August there was a considerable (2·88 inches) but ill-distributed fall of rain. In the beginning of the month the supply was very scanty, and, especially in Ránebennur and Kod in the south, the crops were perishing. The people kept moving to the west, and strangers continued to flock into the district. The importation of grain by human labour was continued, and the cart-rates from Kárwár to Dhárwár fell to £2 8s. (Rs. 24). *Jvári* prices rose from 9¼ pounds the rupee in the beginning of the month to 8½ pounds about the close. In the last days of the month more or less rain fell in every sub-division, and, except in the south, the early crops revived. In the eastern sub-divisions and in Ron the sowing of the late crops was begun. The numbers on public works slightly rose from 21,532 to 21,743, against a small fall on civil works from 2581 to 2355. On charitable relief the numbers rose from 1487 to 1982. In September an average of 7·79 inches of rain fell. The prospects of the early crops improved, but in Hángal and Kalghatgi more rain was required for the rice. The sowing of the late crops and cotton was in progress, and the crops already sown were in good condition. In some places the harvesting of the early crops was begun. Early in the month people moved towards the western sub-divisions, some passing to Kánara; but the movement soon ceased and before long they began to return. About the middle of the

¹ The rates from Dhárwár to Kárwár at these two periods were Rs. 20 and Rs. 16.

² The rates from Dhárwár to Kárwár at these two periods were Rs. 20 and Rs. 12.

month, encouraged by the good prospects, grain-holders opened their grain-pits, and local *javári* began to find its way into the markets. Its competition so considerably checked grain importations, that, though cart-rates from Kárwár to Dhárwár fell about the end of the month to £1 12s. (Rs. 16), there was almost no grain traffic. *Jvári* prices fell from nine pounds at the beginning to thirteen pounds about the close of the month. The numbers on public works rose from 21,743 to 29,290, on civil works from 2355 to 3567, and on charitable relief from 1982 to 3366. October was a month of heavy rain, with an average fall of 10·05 inches. The rice crops, which had to some extent been damaged by drought, completely recovered. The sowing of the late crops went on, but in the north it was kept back by almost constant rain. In some of the moist western lands the excessive wet mildewed the early *javári* and prevented it ripening, but on the whole the crops were in excellent condition. Early *rági*, *sáve*, *navani*, *baragu* and other small grain crops had been harvested and could be had in the markets at rates varying from eighteen pounds the rupee at Dhárwár to thirty-two pounds in Kod. The early crops were ripe, and people began moving west for harvest work. The condition of the people considerably improved. Food and employment were abundant, distress had disappeared, and there was almost no demand for relief. Although cart-rates from Kárwár to Dhárwár fell to £1 12s. (Rs. 16), on account of the competition of the local grain, there was no importation. About the close of the month *javári* prices fell from 13½ to twenty pounds the rupee. The numbers on relief fell, on public works from 29,290 to 14,879, on civil works from 3567 to 2522, and on charitable relief from 3366 to 3109. In November little rain fell. The sowing of the late crops was finished in most parts, but in places the crops were injured by insects. Over almost the whole of the district the early harvest was reaped, the reapers receiving from eleven to twelve pounds of unhusked grain a day. Prices fell from 25½ pounds in the beginning to thirty pounds the rupee about the close of the month. Employment and food were abundant, but labour was rather scarce. The numbers on relief fell, on public works from 3611 to fifty-seven, on civil works from 1623 to 108, and on charitable relief from 3109 to 1076. At the end of the month all relief works were closed. The late *javári* was destroyed in parts of four sub-divisions by locusts, but the crops on the whole were good. Though Government continued to offer charitable relief, the number wanting help fell from 1076 in the beginning to 122 on the 22nd of the month.

The following statement of Indian millet price and of numbers receiving relief shows that during the two last months of 1876 and the first three months of 1877 grain kept pretty steady at seventeen pounds the rupee or more than two and half times the ordinary rate; that its price rose rapidly in April, May, June, and July, till it reached 8½ pounds in August; and that it then quickly fell to 28¼ in November. As early as January the numbers on relief works reached 31,188. By lowering wages and enforcing task and distance tests, in February the total was reduced to 28,454. From this it tesadily advanced till in June it reached 57,320. It then declined

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to 24,098 in August, rose in September to 32,857, and again rapidly fell to 2065 in November, when the works were closed. The numbers on charitable relief rose steadily from 184 in January to 3300 in June. They then fell to 1982 in August, and, after rising to 3366 in September, fell in November to 1076, and in December to 122:

Dhárwār Famine, 1876-77.

MONTH.	AVERAGE DAILY NUMBERS.				AVERAGE RUPPE PRICES.	RAINFALL.
	Relief Works.			Charity.		
	Civil Agency.	Public Works.	Total			<i>Jeári.</i>
1876.					Pounds.	Inches.
November ...	1795	8210	10,005	...	16½	...
December ...	1011	19,432	20,443	...	17½	...
1877.						
January...	792	30,396	31,188	184	18½	...
February...	1481	26,973	28,454	257	17½	...
March ...	2385	29,712	32,097	767	17½	...
April ...	3003	38,999	42,002	1989	15½	2·01
May ...	2371	50,598	52,969	3088	14	2·21
June ...	3469	53,351	57,320	3300	11½	5·11
July ...	2581	21,532	24,113	1487	13½	·51
August ...	2355	21,743	24,098	1982	8½	2·88
September...	3567	29,290	32,857	3366	12	7·79
October ...	2522	14,879	17,401	3109	13½	10·05
November ...	731	1354	2065	1076	23½	·14
December ...	...	...	...	122	...	...
Total ...	28,063	346,949	375,012	20,727	...	30·70
Average ...	2159	25,919	28,078	1723	...	...
Total Cost ...	...	Rs. 12,67,961	73,709	...	...	...
			1,341,670			

*Special
Measures.*

The only special relief measure was helping the hand-loom weavers. In May 1877 Government sanctioned a sum of £150 (Rs. 1500) for their relief. Through their own moneylenders, who voluntarily undertook to advance them yarn and wages, weekly orders were given to the weavers. The coarse cloth manufactured was bought through the moneylenders by Government at such rates as to cover the actual cost of yarn and wages paid in advance. The outturn was used to meet the demand for cloth in the different Government offices, and also in giving clothes to destitute persons on relief works. In September 1877 this special relief was stopped.

Census.

A special census taken on the 19th of May 1877, when famine pressure was general and severe, showed that of 45,711 workers, 41,583 on public and 4128 on civil works, 25,381 belonged to the sub-divisions where the works were carried on; 13,398 belonged to different sub-divisions of the same district; 4656 were from other districts; and 2276 were from neighbouring states. As regards occupation, 2521 were manufacturers or craftsmen, 12,588 were holders or sub-holders of land, and 30,602 were labourers.

Cost.

The total cost of the famine was estimated at £134,167 (Rs. 13,41,670), of which £126,796 2s. (Rs. 12,67,961) were spent on public and civil works, and £7370 18s. (Rs. 73,709) on charitable relief.

The rates of cart hire from Gadag to Kárwár varied from £1 4s. (Rs. 12) from November 1876 to February 1877 to £3 10s. (Rs. 35) from July to October 1877. In Navalgund and Ron the daily cart rates before the famine varied from 1s. 6d. to 1s. 9d. (12-14 as.). In Navalgund these rates continued till March 1877, after which from July to December, they rose as high as 4s. (Rs. 2). In Ron cart rates began to rise from the beginning of the famine (November 1876), until, towards the close of the famine, they were 2s. 6d. (Rs. 1¼) or nearly double the ordinary rate. In Hubli the daily cart rates rose from 2s. 6d. in the beginning of the famine to 4s. between July and October (Rs. 1¼-2), after which they fell to 3s. 6d. (Rs. 1¾) from November to December 1877. In Ránebennur the ordinary daily cart rate was 2s. (Rs. 1); except from January to March when they fell to 1s. 9d. (14 as.), the rates remained throughout as high as 3s. (Rs. 1½).

Twenty-seven relief houses were opened for periods varying according to the local distress. Except the relief house at Dhárwár which was opened in April 1877 and closed in March 1880, no relief house was open for more than a year. The times during which they remained open were at Ránebennur from January to December, at Hubli from March to December, at Naregal from the 29th of April to the 2nd of June, at Hángal, Háveri, and Bankápur from April to December, at Annibhavi from the 17th to the 31st of May, at Sudikavjarji, Álur, Betigeri, Mugod, and Biádgi, and two at Kalkeri from May to June, at Lakundi and Misrikota from May to July, at Dambal from May to October, and in Kalghatgi from May to November; at Hubli during June, at Ron from June to November, and at Navalgund from June to December; at Gadag, from July to December; at Nargund from August to December, and at Tadas and Annigeri from September to November. At these houses 471,815 persons were relieved at a cost of £6232 (Rs. 62,320). The relief houses were temporary sheds, private houses, monasteries, temples, and cotton-gin factories. At Naregal seven miles south of Bankápur a private relief house was kept open from the 3rd of June to the 15th of August 1877, and 1845 persons were relieved at a cost of £92 (Rs. 920).

In addition to their ordinary duties the assistant collectors and district deputy collectors were placed in famine charge of their sub-divisions. Hubli, Kalghatgi, and Bankápur were in charge of the first assistant, Ránebennur, Karajgi, Hángal, and Kod were in charge of the second assistant, and Ron and Gadag were in charge of the district deputy collector. From April to October Navalgund and Dhárwár were placed under a special officer, Mr. E. J. Ebdon, C.S. Special relief officers were appointed at Gadag from March to October and at Bankápur from March to July. Under these officers there were mámlatdárs, clerks, and circle inspectors. Mr. Walton, the cotton inspector, was employed on civil relief works from April to November, and Mr. Young of the revenue survey from about July to October. No shops for selling grain to the poor were opened on Government account. A municipal shop was opened at Dhárwár for a few days, and at Navalgund a shop was opened between the

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27th of October 1876 to the 20th of April 1877 out of a subscription of £500 (Rs. 5000) raised by the well-to-do.

¹ Grain was brought from Bombay through the ports of Kárwár and Kumta in North Kánara and to a small extent through Belgaum from Vengurla in Ratnágiri. Some also came by rail to Belári and from Belári by cart. Almost the whole of the imported grain was *javári*, brought by sea from Sind and by rail from Jabalpur. The Sind *javári* was bought at the ports by dealers of all classes, the largest importers being the capitalists of Hubli and Gadag, who in ordinary seasons deal in cotton. The chief grain markets were Hubli, Gadag, Dhárwár, Háveri, Bankápur, and Ránebennur. The grain was paid for largely by gold and silver. The landholders' capital in the form of ornaments poured into the markets and the goldsmiths' melting pots were going day and night. The course of trade was from the Kánara coast east and north. South Bijápur was largely fed through Dhárwár. In the northern sub-divisions of Dhárwár, Navalgund and Ron, the grain-dealers made no attempt to force prices by keeping back their stocks. At Ránebennur they refused to sell about November 1876, and to some extent in Hubli, Gadag, Bankápur, and Kalghatgi early in 1877. Importations of foreign grain forced them to open their stores. The chief special difficulty in Dhárwár was the number of immigrants, who in the first stage of the famine (September-October 1876) flocked into the western forests on the Kánara frontier, and afterwards were constantly streaming back diseased and dying. Small-pox and fever killed them in numbers. In February 1877 a special officer sent to enquire into their number and condition, reported that there were probably about 20,000 in west Dhárwár and east Kánara. They came chiefly from Bijápur, but many could speak nothing but Maráthi, and some could speak only Telugu. This migration was probably in obedience to a tradition of former famines, that water and food, bamboo seed, wild yams, and other forest produce were to be had in the *maládu* or hilly west. When the charity of the frontier villages was exhausted and the immigrants found that disease and cold gathered as many victims as hunger, and also heard of relief works, they gradually came back to the relief centres which were opened along the western frontier specially to catch them. They were employed by thousands and fed into condition by hundreds, and, on the first rainfall in May, when they began to want to go home, arrangements were made to pass them home by having stores of food at halting places on the main routes. A very large number were regularly marched in gangs. After the heavy rain in June they passed through Dhárwár and Nargund to Bijápur in a continuous stream soaked with rain and caked with mud to their middles. Their only portable property was some of the Government relief-house saucers, earth-work baskets, and here and there a stolen pickaxe. Another difficulty was the failure of bullock power to draw the grain carts from the coast after the rain fell. This failure was due to the bullocks being wanted for

¹ Mr. J. B. Richey, C. S., C.S.I.

field work, to the bullocks not being able to stand the wet on the Sahyádris, to their not being able to draw the carts through *muram* roads deep as a ploughed field, and to bullock power being cut off from the made roads by intervening tracts of black soil. After July men to a great extent took the place of bullocks, dragging carts where there were roads, and, where carts could not travel through the roadless black soil carrying the grain on their heads. There were also difficulties in getting people to go to the particular works to which they were drafted. In some cases they received allowances to go and deserted on the road. The northern subdivisions of Ron, Navalgund, and Dhárwár suffered from want of water and some help was given for deepening wells. Hutting for famine labourers was difficult to arrange; no grass could be had for thatching, and the bamboo mats or *tattis* which were used in the place of grass were not rain-proof.

Few people left the district, though thousands went from the east to the west and some passed over the frontier into North Kánara. There was some little migration into Belári and Maisur from the neighbouring villages drawn to Belári by the easy terms on which relief was given, and, in the later stage of the famine, to Maisur drawn by the nearness to their homes of some of the Maisur relief works and perhaps by more liberal treatment. Compared with 1872 the 1881 census shows a fall of 106,764 in population. The addition of the normal yearly increase of one per cent during the remaining seven years gives 175,000 as the loss of population caused by death and migration in 1876 and 1877. During the first six months of the distress the behaviour of the people was good. They were patient and reasonable, and showed many fine traits of kindly feeling. This lasted so long as families kept together. Towards the end of the hot weather (May 1877) early rain fell, the people were unsettled by the hope of field work and of a speedy end to their miseries, and those who had not submitted to the steady discipline of relief work but were living partly on alms grew demoralized. Families began to break, men left their wives and children, and the lazy used every device to get relief without giving work. The esculent vegetables that sprang up helped to stave off hunger from those who would not work. Private charity grew less and less, and at last when in July there were prospects of another year of famine it ceased. From these causes mendicancy, combined among the Lambánis with thieving and housebreaking, increased through May, June, July, and August. Especially in July and August swarms of people who would not work had lost all care for life or for decency and were unmanageable. Two men, unable to stand, brought to the Dhárwár relief house by the police, were given grain sacks to cover their nakedness and were fed for two days. The second night both evaded the watchmen and left. On the second day one was found dead and naked, the other was brought in on the third day dying. He said they had sold the bags for a copper or two, and wandered round picking up refuse. They could not endure being made to live decently. This is one case out of hundreds. The people who starved at home were few compared with those who wandered. The stay-at-homes could always be found

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by inspection. The wanderers were cunning at keeping out of the way if they thought they would be put into relief houses. One Lambáni girl climbed out of the Hubli relief-house over a high wall three times and was at last found dead.

The loss of farm stock during the famine to some extent hampered the carrying of grain and interfered with field work. The yearly village returns show a fall in the number of cattle from 669,408 in 1875-76 to 519,133 in 1879-80, that is a loss of 150,275 head.¹ The outstanding balances on account of the current year were £33 (Rs. 330) for 1875-76, £7242 (Rs. 72,420) for 1876-77, £4259 (Rs. 42,590) for 1877-78 and £1490 (Rs. 14,900) for 1878-79.

Rat Plague,
1879.

In October 1878 swarms of rats appeared, chiefly in the black soil tracts, and devoured a great part of the cold-weather crops. The rats continued during most of 1879, and threatened to destroy the early crops which in places had to be sown more than once. At a cost of £9517 (Rs. 95,170) nine and a half millions of rats were killed and the harvest was saved.

¹ The increase in the district stock of cattle since 1876-77 is remarkable. The details are :

Dhárwār Stock, 1876-77 and 1881-82.

	1876-77.	1881-82.	Increase over 1876-77.	Per cent.
Bullocks...	176,013	252,222	76,209	43·3
Cows ...	89,014	147,133	58,119	65·3
Buffaloes...	89,172	128,546	39,374	44·1
Sheep and Goats..	125,871	223,556	97,685	77·6
Carts ...	32,442	38,714	6272	19·3