CHAPTER II.—ECONOMIC.

Section A.—Agriculture.

The seasons.

The agricultural or *fasli* year begins, according to the almanac, at the middle of Chait; but in practice the agricultural year begins with the day after Dasehra, or the 11th of the second half of Jeth, on which date agricultural partnerships are formed for the ensuing year. The year is divided into three equal seasons, the hot season or *karsa* including Phagan, Chait, Baisakh and Jaith; the rains or *chaumasa*, including Sarh, Sawan, Bhadon and Asoj; and the cold season, *siala* or *juda*, including Katik, Mangsir, Poh and Magh. The two harvests are known as *sawani* for the autum or *kharif* crops, and *sarhi*, for the spring or *rabi* crops. Work begins with the first rains or, where irrigation is available, even before that. Maize and cotton are sown, and a little early *jowar* sown and irrigated for the bullocks. As soon as rain falls, the land is ploughed up for the autumn crops. When they are once sown, they do not require very much attention, as most of them are not irrigated at all. But the cultivator is hard at work, ploughing his land for the more valuable spring crops; and it is the amount of labour then expended on the ground that chiefly decides their outturn. When it is too wet to plough, there are the banks and ditches to be looked too, cane to be tied up, and plenty of odd jobs to occupy the time. With the cessation of the rains comes the busiest season of the year. The land has to be finally dressed and sown with the spring crops, and the autumn crops have to be harvested. During the cold weather the irrigation and weeding of the spring crops absorb most of the available labour; but if good Christmas rains (*mahawat*) set the bullocks free from the well, land will then be ploughed for sugarcane, tobacco, and even for the autumn staples. Irrigation is continued almost up to the spring harvest which generally comes with a rush, all the crops ripening almost at once; and labour at this season often fetches extraordinary prices. When the spring crops are fairly garnered, little can be done beyond finishing up the tobacco, watering the cane, sowing early maize and *jowar* for the cattle, and getting in the maize and cotton, and even this can only be done where irrigation is available. Consequently this is a season of comparative leisure; and the people occupy themselves, the stars permitting, in marrying themselves and their neighbours.

The weather.

The east or cold damp wind (*parwa*) is the abomination of the cultivator. It breeds, especially when the weather is cloudy and the ground wet, all sorts of pests and diseases, animal and vegetable; and the only point in its favour is that it does not

The weather.

dry the land and shrivel up the plants, as the fierce west wind will do, and that it is often the precursor of rain. It is specially obnoxious when the pollen is ripe and the grains forming, or about Asoj and Phagan. The west or hot dry wind (*pachwa*), on the other hand, if it is not too strong, is hardly ever unwelcome so long as there is plenty of rain; for it does no harm beyond drying things up. It is especially desirable when the plants are young, as it forces them on; and again when the grain is forming; and again when the crops are ripe; but if too strong or too hot, it is called *jhola*, and blows the pollen, shrivels up the grain, and blows down the plants; while in autumn it dries up the moisture upon which the spring sowings depend. After the spring crops the fiery hot wind cannot be too fierce or too continuous, as it dries the grain and makes winnowing easy, and, best of all, it presages a good rainy season. Rain can hardly be too plentiful, in the autumn, at any rate, till the pollen forms. While that is ripening, rain washes it off and does much harm; and again when the grain is ripening rain rots it and diminishes the yield. But the injury is reduced to a minimum if a good west wind is blowing. And rain, after the crops are cut, is especially injurious, as the produce rots on the ground; and even if the grain is saved at the expense of straw, the cattle suffer from want of fodder. The ideal season is one in which rain falls early, so as to allow the autumn crops to be sown over a large area; and falls in sufficient quantity at the end of the rains, so as to leave the ground moist for the spring sowings.

Seed time and harvest.

The approximate sowing and harvest times are given below. These are ordinary times. In an exceptional season the sowing may be further delayed a fortnight or even more, but to the injury of the produce :—

Staple.	Seed time.		Harvest.		Remarks.
	From	To	From	To	
Cotton	1st June ...	15th July ...	10th October	15th November	
Maize	15th „ ...	Do. ...	15th September	15th October	
Coarse rice ...	15th „ ...	Do. ...	5th „	5th „	
Bajra	15th „ ...	Do. ...	20th „	20th „	
Jowar	1st July ...	5th August ...	20th October ...	20th November.	
Gram	1st September	10th October ...	1st April ...	15th April.	
Wheat	20th „	1st November	15th „ ...	30th „	
Barley or mixture of wheat, gram and barley.	1st October ...	1st December	1st April ...	15th „	

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Seed time and harvest.

For the *kharif* crops rain is most needed in June and the first week of July and it cannot be too plentiful. They are also greatly dependent upon the rains in the end of July and first half of August. If it is either too plentiful or too scanty, it injures the crops. Too much rain at the end of September also hurts the crops, as it washes off the pollen from the flowers. For the *rabi* crops rain is most needed in Bhadon (15th August to 15th September) and first half of Asoj (rest of September), when it can hardly be too plentiful; good rain in December and January is also most beneficial. Rain after the first week of March is injurious. In both crops rain at harvest time does infinite damage, as the grain when cut lies in the fields for weeks, and both it and the straw are liable to damage from wet.

Rainfall.

The averages recorded at the tahsil rain-gauges for the last 28 years show roughly the distribution of the rainfall :—

	SUMMER. *April to September.*	WINTER. *October to March.*	TOTAL.
Thanesar ...	25·02	4·29	29·31
Karnal ...	27·33	3·87	31·2
Panipat ...	22·19	3·19	25·88
Kaithal ...	15·56	3·63	19·19
Ghula ...	16·06	3·65	18·71

The advantage of the Khadir and the Bangar tracts, on the borders of which the three first gauges are situated, is sufficiently apparent. There is a marked and sudden diminution of the rainfall as soon as the stiff soil of the Chachra and Nardak tracts are reached. The natural state of this region is extremely precarious, and until the recent extensions of the Western Jumna Canal it was one of the most insecure in the province. The Bangar of Kaithal, especially in the southern villages, is fortunate in possessing a lighter soil where a crop may be raised with far less rain than in the Nardak.

It must not be forgotten that the success of the canal crop depends very largely on the rainfall. The *kharif* of 1905 and the *rabi* of 1908 are striking, but by no means solitary examples, of the failure of canal water as at present distributed to mature a crop when the rainfall is unfavourable.

The method of well-sinking and the religious ceremonies which accompany it are described in paragraphs 404-407 of Mr. Ibbetson's Settlement Report.

Well-sinking.

In the Indri and Thanesar Khadir unbricked wells are made by digging out the sand and lining the lower part, which is of greater diameter than the upper, with a covering (*jhal* of woven withies of *jhao* or *simbhalu* or *tunt*. They are made in a few days, and at a cost of Rs. 5 to 10, spent in buying the lining, and feeding the friends who come to help in the digging after water is reached, which must be hurried on. They fall in during the next rainy season.

Unbricked wells.

The best well irrigation is found in the Panipat Khadir. Owing to the proximity of the Jumna and the canal escape which runs through the northern villages the water-level in more than half the circle ranges from 12 feet or less to 18 feet below the surface. With an expenditure of 4 or 5 rupees and some *gur* to the labourers a well can be dug which, lined with brushwood, will irrigate some twelve acres and last for three or four years. If the water supply is satisfactory the well can be lined with the large bricks described by Mr. Ibbetson in paragraph 407 of the Karnal Settlement Report. He says :—

"Of late years a new kind of brick has been introduced. It is very long and broad and thin and forms a small segment of an annular disc. ... .. Wells are made of a single thickness of these built up dry without mortar. They are cheap, a well built of them costing not more than a third as much as a good brick and mortar well. But it will not last long, while the other will last at any rate 60 or 70 years ; probably more."

An ordinary brick and mortar well can be sunk for Rs. 400 or 500, exclusive of the labour provided by the owner. A lining of large bricks will only cost Rs. 150 to 200.

Well-gear.

The driving gear in a Persian wheel will cost some Rs. 15, and lasts 6 or 8 years. The lanthorn wheel and subsidiaries cost about Rs. 10 more, and only last about a year. The *mat* or rope ladder, on which the earthen pots (*tindar*), which raise the water, are fastened, is made at home, always of *dab*, which resists the action of water better than any other fibre. The whole gear is said to include 360 separate pieces of wood, which enjoy some 70 or 80 separate names among them.

The leather bucket (*charas* in a *charas* well) consists of a buffalo hide bag swung from an iron ring and handle (*mandal*).

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It is drawn up by a strong rope (*lao*) made of *san* fibre, and passing over a small strong wheel (*bhon* or *chak*) fixed over the well. The oxen who draw it run down an inclined plane (*gaun*) dug out by the side of the well, the driver sitting on the rope to bring the strain more horizontal, and return by a less steep incline parallel to it. When the bucket reaches the top, the man who stands at the mouth of the well seizes the rope and pulls the bucket on to a masonry platform (*panhar*) on which he stands. He then bids the driver unloose the rope. This releases the bag, which collapses, and the water shoots into the cistern (*parcha*). The empty bucket is then flung into the well, the rope being held under the foot to prevent it falling too quickly. When the oxen reach the top, the rope is fastened on again, and the operation recommences. The directions to the driver, intermixed with prayers for protection, are delivered in a song, the cadences of which the bullocks soon learn to recognize, and stop, turn, and start of their own accord at the proper moment. The work at the well mouth is very dangerous, as any mistake will precipitate the man into the well. The bucket costs Rs. 10 and lasts a year, the iron ring and wheel Rs. 3 each. The *lao* is made at home. The bucket will lift 320 to 400 pounds of water each time, and there is no waste The *charas* well is worked at a much greater cost of labour, but it is a much more efficient means of irrigation than the Persian wheel. For irrigating with the bucket five men are needed ; two men to catch the bucket *bairia* or *barewala* (from *bara*, bucket), working half a day each, as the labour is very severe ; two drivers, *khambi* or *kilia* (from *kili*, the peg, which fastens the *lao* to the yoke) and one *paniara* to look after the channels and let the water successively into the irrigation beds. There should also be four yoke of oxen, two working at once, one coming up while the other goes down the incline, and changing at noon. The well is worked from dawn till sunset, with 3 hours' rest in the hot weather. Four yoke of oxen will water 3 to 4 acres in five days according to the depth of the well ; two yoke will water 2½ to 3 acres in the same time.

The labour at the Persian wheel is much easier, as expressed by the saying "*Harat ek ankh se chalta*," "one eye is enough for a *harat* "; for the driver (*gaderia*), who sits on the beam to which the yoke is tied, may be blind and the *paniara* only needs one eye. But of course a man for grass is needed. It is better to have four yoke of oxen to change every three hours, as the rotary motion soon tires the bullocks, but there

are very generally only two. A Persian wheel will water 3 acres of land in five days, and a good deal less if the soil is very sandy.

Well-gear.

Wells are seldom the property of a single person. The sharers irrigate in turn for a day or half a day each, according to a *rota* (*bari, osra*) fixed by lot.

Abi irrigation.

Irrigation from tanks, classed in crop returns as *abi*, is practised to a small extent, especially in the Nardak. The method is the same as is followed in canal irrigation by lift.

Watering from tanks is mainly used as an auxiliary to irrigation from wells situated in the homestead lands. A *zamindar* is loth to put up his well-gear in the hot weather, and if the rains are good, the maize will ripen without artificial irrigation, and one watering from the tank will be sufficient to mature the cotton. The *toria*, which is sown in October and ripens in January, is often tank-watered, and in a bad year the land to be sown with wheat gets a preliminary watering from the tank. In the Nardak, where this form of irrigation is most common, there are some large depressions which are filled with water in the rains, round the borders of which rice crops are sown, and watered, if necessary, by lift.

A curious kind of *abi* irrigation is practised on the Ghaggar and its tributaries whose channels are far below the surface of the surrounding country. Wells, sometimes lined with masonry and sometimes *kachcha*, are dug near the river bank, and carried down to a lower level than its bed. In the case of masonry wells the face of the cylinder is exposed on the river side, and low down in it an arch or *jharokha* is built A channel from the river leads water into the wells through this arch, and in the cold weather a small *band* is sometimes thrown across the bed of the stream to hold up the water. Such wells are usually worked by the rope and bucket. This *abi* irrigation was formerly of more importance than it is now. It is at best precarious and has become more difficult as the channel of the Ghaggar has become deeper.

Canal irrigation.

The water passes from the canal by a head (*mohand*) into the main distributaries (*rajbaha*). From them it is distributed by small channels (*khand, khal*) to the fields. Each main channel supplies many villages, and each village has its turn of so many days. Irrigation from the canal is practised in two ways. If the water is delivered above the level of the fields, the irrigation is called *tor*, or flow ; if below them, *dal* or lift. In flow irrigation all that is needed is to cut a hole (*naka*) in the channel

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Canal irrigation.

and let the water on to the field. The area that can be irrigated in this manner in five days is only limited by the supply of water: one good opening will water 30 to 50 acres. Irrigation by lift is practised thus. The water is brought up by a low-level channel which is met by a high level channel into which the water has to be lifted. The end of the lower channel is enlarged and a small pool (*chuhi*) dug out: on either side of this standing places (*penta*) are dug in the banks. The end of the higher channel is also enlarged into a basin (*nyani*) which is cushioned with grass to prevent the falling water from scouring. Two men called *dalia* then stand one in each *penta*, and swing between them the *dal* or scoop. This is in the shape of a small canoe, and is made of thin planks of *dhak* wood sewn together, with leather, costs 8 annas and lasts a year. It is swung by four strings, two at each end on either side of the point. The *dalias* take a string in each hand and swing the scoop, dip into the water, swing it out full of water up and over the *nyani*, and tip the water out by tightening the upper strings. The operation is performed with wonderful skill, but the labour is very severe, and a man can only work for an hour consecutively at it, and cannot work two days running. The outside height of the *mathik* or bank over which the water is to be lifted is 4½ feet; if the total lift is greater two lifts are used, one above the other. It takes four *dalias* and one *paniara* to work a *dal*, and they will water 3 to 5 acres in five days according to the height of the lift.

Agricultural implements and appliances.

Agricultural work is generally done by oxen, but male buffaloes are now frequently yoked in carts, but are sometimes used for the plough. In the light soil of the Khadir, with water near the surface, small cattle, costing Rs. 20 to 25 each, will do all that is needed. But for the stiffer soil of the Bangar plough cattle now cost Rs. 60 to Rs. 80 each, while oxen, that can do a full day's work on the deep wells of the Nardak, cannot be got under Rs. 100 or Rs. 120 each. An ox begins work when rising 4, and works for 10 years. For a bucket well eight oxen is the full complement; for a Persian wheel, four. A plough is now always reckoned at two bullocks. It used to be reckoned at four; the change is due to the greater sub-division of land owing to increased population, as many of the agricultural accounts are kept by ploughs.

Fodder.

Fodder in general is called *nira*. The fodder of the autumn crops consists of the stalks of the great millets and of maize, which are carefully stacked on end in a stack called *chhor*; of rice straw which is merely piled up in a heep (*kunjra*); and of

Fodder.

the *bhus*, or broken straw left after thrashing of the pulses. The spring crops give *bhus* only, also called *turi* if of wheat or barley. *Bhus* is stored in a *kup* made of a wisp of straw *(thanda)* wound spirally round and round upon a foundation of cotton stems so as to form a high circular receptacle in which the *bhus* is packed and preserved and thatched when full. A long low stack fenced in by cotton stems alone is called a *chhan* or *bhusari*. Near the city the people store their *bhus* in mud receptacles (*khutá*) and plaster it all round the top. The *bhus* is taken out from a hole at the bottom as wanted. Stems of millet and maize are chopped up into small pieces (*sani* or *kuti*) before being given to the cattle. An ox during ordinary work will eat 20 sers of grass and a *ser* of grain daily ; if working at the sugar-mill or well bucket, nearly twice that. The cost of stall-feeding may be taken at about 4 annas a day. Of course the fodder varies according to the season. The mass of it consists of grass and straw of cereals ; a little pulse straw is always added and green food when obtainable. In the cold weather *methi* and rape and carrots, and at all times the weedings, are given to the cattle. Besides this some cotton seed or oil-cake, or either *gwara*, *moth*, or gram, is daily given. The best fodder of all is the straw of the small pulses, and is called *missa ;* after that of wheat and barley, called *turi ;* after that the *jowar* stems or *chari*. *Bajra* stems are seldom given alone. They are chopped and mixed with one-third of *mung* fodder, or failing that, with some oil-cake (*khal*) or pea-meal of gram. In famines the cattle will eat almost anything. The sacred pipals are stripped and even the thorny *hins* is cut up and given to the starving beasts. Where sugarcane is grown it is cut green to keep the bullocks alive. In Kaithal although *bajri* stalks furnish but poor fodder, the Jat of the southern Bangar is too hard pressed for food for his cattle to throw them away, and *bajri* ricks, often blackened with age, scattered here and there about the fields, are a curious feature in some Bangar estates. Such ricks are kept even for six or seven years, if the occurrence of severe drought does not cause them to disappear sooner.

Manure.

The dung heap (*kurri*) is started when the rains are over. A great hole is dug in the ground, and straw, cattle bedding, sweepings of horse and cattle sheds, and all sorts of refuse, are thrown into it. During the rains the cow dung is too wet to be patted up into fuel cakes and is all thrown on to the heap. The rain is allowed to fall freely upon it, and it is periodically turned over and worked up by the sweepers. As soon as the rains are

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over, it is fit for use. It is taken to the field in carts, sprinkled by the sweepers, and ploughed in. Manure proper (*khar* or *khat kurra*) is not very often used as a top-dressing. But the market gardeners largely use the nitrous efflorescence (*rehi*) found about the village homesteads as a top-dressing for young wheat. The similarity of the name has led to statement that the injurious saline efflorescence or *reh* which covers so much of the country is used for manure. This is not the case in Karnal. *Reh* consists chiefly of sulphates, and is injurious; *rehi* of nitrates, which, of course, are the best of manures. Weeds, grass, and plant stems, and roots which cannot be used as fodder, are generally burnt on the fields and the ashes ploughed in. The great object of the cultivator is to get enough manure for his sugarcane. After that, what is over is divided between fine rice, cotton, maize, and the best wheat land; but these crops, excepting rice, are often sown after sugarcane, when no fresh manure is given. In the Nardak manure is little used on the unirrigated land, as the people say truly that in the stiff soil with a scanty rainfall it only burns up the plants.

After more than 15 years of canal irrigation one might expect that the Kaithal farmer would have learnt to utilize manure, or have devised some principles of rotation. But holdings are large and the soil is still supposed to be fresh and full of strength. Heaps of farm refuse are still piled round the village site, while there is ample evidence, admitted by the owners themselves, that the older fields are showing signs of exhaustion. Hitherto the *zamindar* has been content to increase the area under the plough, and to blame the Canal Department when the unmanured and carelessly weeded fields display a diminished outturn. Great as has been the change wrought by the canal, the agriculture of the Kaithal uplands will undergo a still more important revolution when the pressure on the soil brings home to the people the necessity for intensive cultivation. At present even sugarcane is sometimes grown without manure and the plants frequently get no manure before sowing, though a top-dressing is usually given when the young shoots begin to appear. Wheat and cotton as often as not are left unmanured. Compared with the careful tillage of Panipat, the canal irrigation of Kaithal presents an unkempt and neglected appearance.

The plough and minor agricultural implements.

A description of the plough used in Karnal and of the minor agricultural implements as well as full account of agricultural operations from the ploughing of the land to the measuring out of the grain will be found in paragraphs 413, 414, 424-436 of **Mr. Ibbetson's Settlement Report.**

Many of the evils to which plants are subject are peculiar to particular staples, and are noticed in their places below. But a few are very common :—

Diseases and enemies of plants

Pa'a or frost is very injurious if severe and not accompanied by rain, or if a west wind blows at the time. There is a saying *giria min pacheia paia ; yih kirsan ka gaia :* "a rainy rain and frost are the husbandman's loss." It specially attacks cotton, sugarcane, gram, rape, and early wheat while in the ear.

Kag, kagwa, or smut is produced by east winds with cloudy damp weather. It attacks wheat especially, and also *jowar* and sometimes barley. But it is, as a rule, sporadic in the two latter.

Al or *ala* is a black oily appearance upon the leaves of cotton and sugarcane. But it is also the name of a gregarious caterpillar, which especially attacks cotton, rape and seasame.

Kungi or rust is produced by the same influences which produce smut. It attacks wheat chiefly, and is exceedingly destructive.

Jackals do most harm to maize, of which they "do not leave even the bones" and to sugarcane. They also eat *methi* and safflower.

Pigs are catholic in their taste ; but if they have a preference, it is for rice, *jowar*, maize and cane

White ants eat most things, especially gram, cotton and cane. They cannot move in *dakar* as it is too stiff and moist for them ; and plenty of water will keep them away.

Ujala or general withering up from any reason, and *okha* or withering up from want of water, are of course evils common to all plants.

Cultivation of *barani* lands.

Purely *kharif* cultivation is chiefly found in the case of *kalar dahr*. By far the greater part of the rice land is of this description. In a year in which the rainfall is seasonable and abundant, a crop of coarse *santhi* rice can be raised, but the soil is too poor and stiff to yield a spring crop.

There is also some very sandy soil in the Khadir, and some high land off which rain water drains rapidly in all the assessment circles, in which only inferior autumn crops, such as *chari*,

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bajra and *moth* can be grown. Such high land is locally known as *thali*. It is less usual to find land which is only cultivated in the *rabi* harvest. This system is chiefly followed in the case of land which lies so low as to be usually under water in the rains, and there is little of this description, except in the Khadir.

Three-fourths of the *barani* land is of the kind known as *magra*. The people have learned that where the *magra* is at all level, the most profitable method of farming is to put in a spring crop in the end of one agricultural year, and an autumn crop in the beginning of the next, after which the soil is given a year's rest. There are obvious advantages in adopting this system. After the *kharif* harvests, the land is exhausted by the fact that it has borne two crops in succession, and it is also, as the result of the rains, overgrown with grass and weeds. Besides the pulses, *chari* and *jowar*, raised on unirrigated land, are not reaped until the season for sowing gram is past. An industrious man ploughs the land as soon as rain falls in January, eradicating the weeds and exposing the soil to the air. If the spring crop to be raised is gram, the land will not be ploughed again till July, and possibly not till September. The gram is sown in land which has recovered its strength and is tolerably free from weeds. The growth of weeds and grass in the cold weather is insignificant, and the *chari* which succeeds the gram is also grown in comparatively clean soil.

Outside the Khadir Circle the wells are classed as *gora* or homestead wells, and *jungal* or outlying wells. The former are those situated in the lands immediately surrounding the village. One reason for the fertility of such land is well known. But, besides, in these two circles, all the manure is expended on the homestead fields. The cultivation is, therefore, to a large extent, *dofasli*. Where the people are very industrious, and manure is plentiful, one finds double-cropping all over the area watered from the *gora* wells. If the supply of manure is limited, the *dofasli* area is less. As a rule, the inner belt of the *gora* lands is usually *dofasli*, while the outer belt is mainly *ek-fasli*. Where the Bangar cultivator intends to take a double crop, he ordinarily puts in maize in June, manuring the fields heavily. This manure is intended to benefit both the autumn and spring crops. Indeed its effect on the latter is probably greater than on the former. As much as 600 or 700 maunds of manure per acre is sometimes put in, but usually half this quantity is considered sufficient. Maize in the Bangar is generally followed by barley or carrots; or, where the tillage is somewhat inferior, by a mixed

crop of gram and *toria*. In the best Bangar villages, and almost universally in the Nardak, wheat follows maize. In the outer *gora* fields, wheat is often cultivated as the sole crop of the year, or wheat is followed by cotton, and the land allowed a year's fallow after the cotton has been picked. In all but the very best Bangar estates, the *gora* lands are mainly devoted to raising the food of the cultivator. It is different in the Nardak, where there are fewer outlying wells on which to grow the revenue-paying crops, and where the character of the soil favours the cultivation of wheat. The Nardak *gora chahi* cultivation, except in the villages in the north-east of the circle, is inferior to that in the Bangar. In the south maize is sown as an unirrigated crop on the homestead well lands, and in these circumstances manure would be harmful, and is not used. Nor is the irrigated wheat which follows the maize manured.

Cultivation of *barani* lands.

The outlying or *jungal* wells are cultivated on the *ek-fasli* system. The lands attached to them are not manured. The object of the *zamindar* is to raise as much wheat as possible upon these wells; but experience has taught him that, even though the land is not cropped in the autumn harvest, it is impossible to put in wheat more than twice in succession without exhausting the soil. Provided the land is treated properly, the produce of the unmanured wheat on the outlying wells is supposed to be superior to that of manured wheat grown in the homestead fields. In order to restore the quality of the land, unirrigated gram is substituted for wheat in the second or third year, or the wheat is followed immediately by cotton, *urd*, or *chari*, and the land is left for a year, after which it is again sown.

It is the cultivator's object not to be compelled to work these wells in the autumn harvest. If he is lucky, even the cotton will ripen without artificial irrigation. The area attached to the well is often far larger than can be watered in any one year, and a considerable part of it will be found in any particular harvest under dry crops.

In the Thanesar and Indri Khadir manuring is not confined to homestead fields or even to irrigated lands. Manure is carried out much further from the village site than in the upland villages. In the south of Indri Khadir Circle however the system of tillage is more like that prevailing in the Bangar. This becomes increasingly evident when the Bangar of the old Karnal Pargana is passed. In the Khadir of the Karnal Pargana and

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Panipat either because there is less moisture from the canal or because the inhabitants are superior in energy and resources to those of the Indri Khadir, the wells are worked far harder. While in Indri the cultivator relies for his autumn crop on the rain and moisture afforded by the canal, the wells in Karnal and Panipat are worked to supply irrigation for cotton sowings in May and June and a little *jowar* for the bullocks will be sown in the irrigated land. Sugarcane and the valuable garden crops of Karnal and Panipat town receive attention from the wells throughout the season.

Sugarcane.

The principal varieties sown are *surta* or *sotha*, with a long, soft, thick, white cane ; the best of all, but somewhat delicate, and especially fancied by jackals *Lalri*, with a hard, thin, red cane ; very hardy, and will not spoil even if the cutting be long delayed, but not very productive of juice. *Merathi*, with a thick, short, soft cane and broad leaves : it is very productive but requires high cultivation, and suffers from excess of rain : it is not much grown *Paunda*, a thick sweet variety ; grown near the cities for eating only, as its juice is inferior. Cane grows best in fairly stiff loam, and worst in the sandy soil. It likes abundant rain and will stand a good deal of swamping, though too much makes the juice thin. It is occasionally grown in flooded land without irrigation, but the yield is poor and precarious. Its cultivation is far more laborious than that of any other staple. The land must be ploughed at least ten times, and worked up to the finest possible condition. The *zamindars* say :—*Gehun bisi, ikh tisi, i.e.*, plough wheat 20, and cane 30 times ; but that is a counsel of perfection. The more manure given the better the yield ; and it is never sown without. If the soil is impregnated with *reh*, the juice becomes watery and yields but little sugar. Cane is occasionally grown a second year from the old roots and is then called *munda*. The yield is inferior. A full account of the cultivation of cane and the manufacture of *gur* is given in paragraphs 444-447 of Mr. Ibbetson's Settlement Report.

Young sugarcane is attacked, when about a foot high, by a worm called *kansua*, especially if the east wind blows. A smut called *al* also attacks it under the same circumstances. Mice do much harm, and also white ants and frost. The *kolhu* or native sugar mill has now been superseded by the Behea mill with iron rollers.

Cotton.

No varieties of cotton are recognized by the people. It grows in stiff loam, worst in sandy soil. It is better,

if possible, to grow it by the aid of rain alone and without irrigation after sowing at any rate till the rains are over. The more manure the better; but it often follows sugar, when no fresh manure is given; and in the Nardak it is grown without manure. As it can be grown without manure, it is favourite crop on outlying (*jungal*) wells. On the canal it is sown a full month earlier than elsewhere as the ample supply of water enables the cultivator to make the land moist enough before sowing to carry it through till the rains. The ground is ploughed twice and the *sohaga* used; the seeds are rubbed in cow-dung to prevent their sticking together and sown broadcast. When the two seed leaves appear it is weeded, and twice again after that; the saying being—

Naulai nahin dopatti,

Kya chugaoge kupatti.

"If you don't weed when there are two leaves, you will pick nothing."

When it begins to flower it especially wants water, which must be given if necessary; for if it dries, and especially if the east wind blows at the same time, the flowers fall off and the pods don't form. It generally gets watered again with the other crops which are sown among the plants.

The picking is done gradually as the pods open. It is performed by the women of the house when they are not secluded; otherwise by the poor women of the village who take one-twelfth of the pickings in the ealier pickings when there is plenty of cotton, and more, up to one-fifth, as less and less remains to pick. The last gleanings are left for the poor. The cotton as picked is called *kapas*, and is passed through a small hand-mill (*charkhi*), consisting of a wooden roller revolving in contact with a very small iron roller, the latter nipping the cotton and drawing it through and so tearing it off the seeds (*binola*) which are left on the other side. The *kapas* consists of about a third cotton and two-thirds seeds. The cotton thus ginned (*rui*) is scutched (*pinna, dhunkana*) by the *pumba* or *teli* with a large double stringed bow (*pinan, dhunaka*) hung from a flexible bamboo, the strings of which he twangs violently with a heavy plectrum of wood (*tara*) and the vibrations toss up the filaments and form them into a fleece, leaving the dirt at the bottom. For this he takes the weight of the cotton in grain. The women spin the cotton and give it to the weaver to weave, paying him one rupee for weaving about 60 yards. This village industry, however, is declining as more and more cotton finds its way to the cotton

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ginning factories at Panipat, Karnal, Kaithal and other centres. The *kapas* is bought in the villages by agents of the factories who occasionally enter into forward transactions with the *zamindars* to supply so much *kapas* at a fixed rate. After the cotton is picked, the cattle are turned into the fields to eat the leaves and dried stems (*bansati, banchatti*) are cut down and used as withies for various purposes, or for fuel. The seeds are a valuable food for cattle, as they are very full of oil. Cotton is especially liable to the *al* smut, and to attacks of caterpillars, and of a red worm in the pod.

Maize.

Two sorts of maize are grown—the *pili* or early yellow maize, and *dhauli* or late white maize. The former has the better grain, and the latter is the more valuable and ripens fifteen days later. Maize must have plenty of water and must have at any rate a little fresh manure, even if sown after sugarcane. It grows best in light soils and well in sandy ones. It will not grow in very stiff soil. The ground is carefully dressed and the seed sown broadcast. It is weeded on the 10th, 22nd, and 35th day after sowing, or thereabouts. It cannot go a month, and should not go more than three weeks, without water; and it is only in good years that it need not be irrigated. If it once dries up, no after watering will save it. A little early maize is often grown as fodder for the cattle; it produces hardly any grain. The maize is cut down and the cobs (*kukri*) picked off, stripped, dried in the sun, and beaten with sticks to separate the grain. The unripe cobs (*bhuta*) are often roasted and eaten. The stalks (*karbi*) are good fodder, though not good as *jowar*. Maize suffers from a worm in the knot of the stalk, and especially from pigs and jackals. In Indri maize is an important crop on well and *sailab* lands. In Kaithal its cultivation is mostly confined to well lands in the Powad, but a little is grown on *chahi* lands in the Bangar and Naili circles of Pehowa.

Fine rice.

Rices are divided into two well-defined classes,—the fine rices, varieties of *oryza sativa*, the grains of which cook separate, and which are known to the people under the generic name of *siri;* and the coarse rices, varieties of *oryza glutinosa*, the grains of which agglutinate when boiled, and of which the principal sorts are *mun,i* and *santhi*. The *siri* proper is a small rice with a short straw; the principal varieties are *rumali* and *ramjamni*, the latter of which has a particularly hard fine grain. *Sunkar* and *ansari* are coarser rices, chiefly grown where there is fear of too much water, in which case their

long straw gives them an advantage. Rice grows only in stiff soil. It is usually grown in lowlying *dakar* so as to take advantage of the drainage water; but if the water supply is sufficient, the best rice is grown on fine stiff soil on a slope where the water is perfectly under control. The seed beds are ploughed four or five times and carefully prepared, manure is spread on them, and the seed sown broadcast and very thickly on the top of the manure. More manure is then spread over the seeds, and the whole is watered. Four days after they are again watered, and after the fifth or sixth day, they must be kept wet till they are ready to plant out. The rice field is ploughed twice, and such manure given as can be spared. It is then flushed with some three inches of water, and a *sohaga*, toothed if there are weeds, is driven about under water (*garh* or *gahan dena*). If the weeds are obstinate, the plough must be used again under water. When the *sohaga* has worked up the mud into a fine slush, Jhinwars and Chamars take the seedling (*pedh*) in handfuls (*juti*) and plant them one by one in the water pressing in the roots with their thumbs. An acre will take 500 to 600 *jutis* which will cost, if bought, Re 1-4-0. It will take ten men to plant it in a day, and they get 2½ to 3 *sers* of grain each daily. The field is weeded once at least. At first the whole field must be kept under water continuously; for each seedling throws out five to ten new shoots, which cannot make their way unless the ground is pulpy, and it is on the abundance of these shoots that the crop depends. The water must not be more than 6 inches deep, or the shoots will be drowned before they get to the air, and it must not be changed, as it would carry away all the strength of the manure and the soil. When the ears once begin to form, the ground must be kept well wetted, but not too slushy, or the plants will fall. If the crop is wholly under water for more than four days, it dies. The reaping must be done directly the grain is ripe, or it will fall out of the ears into the water. Thus hired labour is a necessity, and the payment is 5 or 6 *sers* of unhusked rice. If the water is deep and the plants, as cut, have to be put on bedsteads to keep them out of the water, the reaping is slow: otherwise the same as with other small cereals.

Fine rice.

The rice is thrashed in the ordinary manner, but the grain has to be husked. Standing rice is called *dhan*, as is the unhusked grain, in contradistinction to husked, *chawal*. The husking is generally done by the women of the house. If done by a labourer, he returns 18 *sers* of *chawal* from every 30 *sers* of *dhan*, keeping

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about 2 *sers* of good rice and as much of broken bits which he will grind up and eat as bread. The rest is husk, which is useless. The straw (*parali*) is very poor fodder, and is used largely for bedding for cattle, and for mixing with manure, or is even ploughed in fresh. But it is also given to cattle to eat. Rice suffers much from *khad* or *kokli*, apparently aquatic larvæ or other animals that eat the young sprouts. Water birds, too, play terrible havoc with it when it is ripening If the whole plant dries up, it is called *malain;* if the grain only, *pa'as* is what is the matter with it.

Fine rice.

Coarse rice.

Coarse rice is of three kinds,—*chalaka*, *munji* or *ahaulu*, and *santhi*. *Chalaka* is grown to some extent in the Naili. It is an intermediate variety between *siri* and ordinary coarse rice, has a white grain with a broad husk of a purplish red colour at the tip, and a longish beard of the same colour. The peculiarity of *dhaulu* is that it cannot be drowned out, the straw lengthening as the water deepens. It is therefore sown in spots liable to flooding It will stand two feet deep of water; and if the ripe plant falls into the water, the grains do not fall out as they do with *ziri*. It has a larger grain than *santhi*, from which it is also distinguished by the fact that the grain stalk, when the seed is ripe, separates itself from the sheath. The grain of *santhi* has a black husk, and ripens within the sheath. It is sown in Sarh, earlier than any of the other kinds, and its peculiarity is that it ripens within an extraordinarily short time, nominally 60 days (hence its name) from the sowing. It is sown all over the Nardak, and generally wherever there is no irrigation, as the rains will usually last long enough to ripen it. Huen Tsang noticed its quick growth with admiration when he visited the Nardak 1,500 years ago. *Santhi* has a short straw and does with but little water, it being sufficient if the soil is thoroughly moist after the shoots are once up. The young shoots are liable to be eaten, and if the water gets very hot they will sometimes rot; but the plant is wonderfully hardy, and when the stalks have once grown up, hardly anything hurts it. Both *dhaulu* and *santhi* are sown at once where they are to grow. After one or two ploughings cattle are sent in to the water to walk about and stir up the mud or the *gahan* or toothed *sohaga* is used under water. The seed is sown broadcast on the *gaadal* or fine mud. No manure is used nor is the crop irrigated. The *parali* or straw is better fodder than that of *ziri*, but still not good. The coarse rice forms a staple food of the people, the fine rices being sold and seldom eaten by them.

There are two varieties of *jowar*,—the *pili* or *alupuri*, which gives a sweet large grain, but is delicate, and the *daul*, which is very hardy. *Jowar* grows best in medium loam, and is not grown at all in very sandy soil. It is seldom either manured or irrigated, but it is grown on well-land in the Andarwar Circle of Kaithal and watered, if necessary. Throughout the Kaithal tahsil it is a very important crop and is usually grown for grain mixed with *urd*. The land is ploughed two or three times, and, if very dry, a *sohaga* is passed over it. The seed is sown broadcast, if grain is wanted, very sparsely (*chhida*), the plants growing large and strong, and yielding fine heads of grain; if fodder is the object, very thickly (*sanghni*), the plants growing together with thin stalks, giving little grain, but an immense deal of fine sweet fodder. If sown for grain it is weeded once at least twice, if possible; and small pulses are often sown with it. When the crop is cut, the heads (*tasri*) are picked off and the stalks (*chari*) stacked for fodder. The finest heads are selected for seed and thrashed with sticks, and the others thrashed in the ordinary way. The seed heads are covered with a down which irritates the legs of the labourers. If the fodder crop in any field is very inferior, from late sowing or scanty rains, it is cut green, and is then called *chib*. *Jowar* suffers from worms in the *gata* or bud; and a worm also eats the stalk, which then turns red and hollow inside, and no grain forms. But the plant is exceedingly hardy; and if there is plenty of rain, hardly anything hurts it. It is said to exhaust the soil more than most other crops. Most of the bread eaten by the people during the cold weather is made of *jowar* flour.

Jowar and *Chari*.

Bajra is little grown in Panipat or Karnal, but is after *jowar* and gram the most important unirrigated staple in the Kaithal tahsil, where it is usually sown mixed with *mung*. In the Andarwar Circle it is often grown on well lands. It thrives best in sandy loam such as is found in the south-west of the Kaithal Bangar. It is sown much earlier than *jowar*. The mode of cultivation is just the same as for *jowar*; but it is always sown exceedingly sparsely, and some small pulse is generally sown with it and grows between the plants. The stalks are called *dandar*, and are poor fodder compared with *chari*. In the Bangar villages of Kaithal, however, the *bajra* stalks are carefully stacked and are sometimes preserved for years, and are given to the cattle chopped up with green fodder, or even with the *ata* of gram. If rain falls on the flower (*tur*) it washes the pollen off; but hardly anything else affects it.

Bajra.

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No varieties are recognised. It is grown in fairly stiff soil, but chiefly in the Khadir and there only in small quantities. It is sown in seed beds carefully dressed and manured. The seedlings are then planted out in land which has been twice ploughed and dressed with the *sohaga*. It is watered once, or twice if the rains are late, and weeded once. The heads ripen slowly and the ripe heads are picked off and the grain beaten out. The *bhus* is very bad fodder, and is generally burnt as it stands, or grazed down. The flour is used for bread, but is very indigestible; but it has the advantage that it may be eaten on fast days, as it is plucked, not reaped like other cultivated cereals. It is the *ragi* of southern India. In dry seasons its cultivation as a food crop is largely increased, it being put in fields intended for *siri* which cannot be planted out owing to the drought.

The *kharif* pulses.

It is very difficult to state with any accuracy what the area under the *kharif* pulses is, as they are usually sown with *jowar*, *chari*, or *bajra*. In the Kaithal Powad, however, *moth* is commonly sown alone. It is sown in light or sandy soil. The ground is ploughed twice over, and seed sown broadcast, and neither weeded, manured, nor irrigated. The *bhus* yields the best fodder of all the *kharif* pulses, but it cannot be stored, as it only lasts for one year. *Moth* with the grain unthrashed is a valuable fodder. The seeds of *moth*, *urd* and *mung*, when husked and split, are called *dal*, and eaten largely by the people, generally boiled.

Urd grows in stiffer soil than *moth*. The *dal* is of the finest description, but the *bhus* is inferior to that of *moth*

Mung is almost always sown and reaped with *jowar*, unirrigated maize or *bajra*, chiefly with the latter. The *bhus* is not so good as that of *moth* or *urd*, but is still very good indeed. *Moth*, *urd* and *mung* are very apt to be ruined by over-saturation in the Khadir.

Gwara is a pulse cultivated in much the same manner as those above mentioned. It is grown for cattle only, the grain is boiled, and given as a fattening food to bullocks. Or it is coarsely ground and given dry. The *bhus* is worthless; but the green plant is cut and chopped up and given to bullocks. It grows only in light soil, and is sown with the first rains, and always alone.

Til.

No varieties of *til* are recognized. It must be grown in good stiff soil; and the soil must be new to give a good crop, which is probably the reason why it is chiefly cultivated in the

Nardak where virgin soil abounds. It is generally sown with *jowar* or *bajra*. When the plants are cut they are put up on end to dry. As they dry, the pods open, and the seed is then shaken out. The stems (*dansra*) are of no use. The seed is taken to the oilman, who returns two-fifths of the weight in oil, keeping the oil-cake (*khal*) which he sells. The oil is good for burning, and is the best of all oils for purposes of the kitchen. *Til* is very subject to attacks by caterpillars (*al*). And if it once dries up it never recovers.

San and *sani*.

San is sown, seed by seed, on the edges of the sugarcane field, or in rows among the cotton, and takes its chance with them. It is cut in Katik. The plants dry for two or three days, and are then, or when wanted, weighted down under water in the pond or in a well. They soak for 40 to 60 days in the cold, or 20 days in the hot weather. The fibre is then stripped off, washed thoroughly, dried, and is ready for use. The sticks are called *sankokra*, and are useless. The fibre is especially used for the *lao* of the well, as it is very strong, and stands water without rotting. It is also used for ropes in general; but does not wear so well as *sani*.

Sani is sown in sandy soils, especially in the *bhur* near Panipat. The land is ploughed once, the seed is sown broadcast, and no further trouble is taken with it. It is sown in Sarh and cut in Katik. It is dried and then steeped for 8 to 10 days in the cold, or half that time in the hot weather The stems are then washed, dried, and put away whole, the fibre being stripped off as wanted. It makes the best ropes of all, but will not stand constant wetting. The sticks are called *sunki*, and are useless.

Wheat.

Wheat forms the chief spring staple of the Jamna Khadir. The principal varieties are the *pila*, the best of all wheats; *kunja*, with a long straw, and full ear, of somewhat inferior grain; *jogia*; a short wheat of good quality; and *lal*, a very hardy and productive wheat of good quality, which does with less water than the others, and is sown in the inferior soils and in unirrigated tracts. There is also a beardless variety called *mundli*. Wheat and gram are very commonly sown together, especially in a year when failure of rain in September prevents the sowing of gram alone, but rain falls in October. Wheat will grow in almost any soil except the very stiffest where barley takes its place; and if there are good Christmas rains (*mahawat*) a fair crop may be got without irrigation. It is not grown alone as an unirrigated crop in the Indri Nardak or anywhere in Kaithal except in the Pow-

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and the flooded parts of the Naili. The soil is worked up in the most careful manner during the rains; and the oftener it is ploughed the better. It is generally sown after cane or maize, when no fresh manure is added; otherwise manure is almost always given, and the Malis and Rains use a top dressing of *rehi* of some 12 or 15 maunds to the acre, when the plant is six inches to a foot high. The field is dressed laboriously with the *sohaga*, and the seed sown broadcast. It is watered 20 or 30 days after sowing, according to the original wetness of the soil; and then, at intervals of a month, three times more on the canal, four times more in the Khadir. It is weeded after the first watering; and once again, in the Khadir at any rate, where the *piazis* (weeds) are numerous. It ripens suddenly and hired labour is generally needed for the harvest, the labourers getting 5 to 7 *sers* a day in the ear. The *bhus* is very fine fodder. The grain of wheat alone is not much eaten, it going to the Bania, while the people eat the mixed grains mentioned below. Wheat is very liable to smut, often called *dhaunchi* in this case, and rust (*kungi*). Sometimes the east wind in dull weather will make the ears curl and twist up; and this is called *maroria*. Late frost does it much harm if it has been sown so early that the ear is then forming, but not otherwise.

Wheat.

Barley.

Barley sown alone is not an important crop in Karnal. It is the hardiest of all cereals, will grow in any sort of soil, and will stand either excess or deficiency of water. It may be sown later, too, than any other of the spring crops and men may be seen sowing barley at the very end of the season on the edges of a swamp which is still too wet to plough, with the intention of ploughing it in as the soil dries. The limit to the sowing is expressed by the proverb, "*boya poh, diya kho,*" "sow in Poh and you lose your seed." The field is ploughed two to four times, the *schaga* is passed over it, and the seed sown broadcast. Manure is given if there is any to spare, which there seldom is, and water is given if the needs of the other crops allow of it. It is seldom weeded unless the weeds are very bad. The grain is much used by the people for bread; and the *bhus* is admirable fodder. Barley sometimes suffers slightly from smut; but nothing else seems to touch it, windy weather of course excepted.

Gram.

Gram is the great barani *rabi* staple in the Indri Bangar, the Karnal and Indri Nardaks, and throughout Kaithal, except in the Powadh. It grows best in stiffish soil. It is generally sown broadcast and is often mixed with wheat or barley. In the very stiff rice fields the *dakar* is ploughed up once after the rice

is cut, so as to break it up into large hard clods, in the crevices between which the gram grows. Lighter land is ploughed two or three times and is sown more sparsely than stiff soil. No manure is used ; and irrigation rots the plants, so that the soil should be very moist for sowing. If this is the case and Christmas rains are good, a fine crop is almost certain. Gram is never weeded. The grain is used as *dal*, and for bread, often in the latter case mixed with cereals. The *bhus* is admirable fodder. The young plant is used as a vegetable, the green seed is eaten raw, and at harvest time the plant is thrown on to a fire of grass, and the roasted seeds (*hole*) rubbed out and eaten. Either the phosphoric acid which the leaves deposit, or the down with which they are clad, is exceedingly irritating to the skin. The plant is exceedingly sensitive to frost ; and a green worm, called *sundi*, attacks the seed, especially if the Christmas rains are late, so that the ground is damp when the seed is forming.

Masur is a small pulse, growing chiefly in the very light soils of the Khadir. The ground is ploughed twice, and dressed and the seed sown broadcast, often mixed with barley. No manure is used ; but it is irrigated if the labour can be spared. The grain makes very good *dal* ; but the yield of fodder is insignificant. *Masur o Masri.*

It is difficult to say what the area under *sirsam* is as it is usually sown together with wheat or gram, often in rows (*ad*). It is largely grown in Kaithal, but the area fluctuates to an extraordinary degree with the character of the season. Two kinds are grown in the tract ; the black which is more hardy but less productive, and the yellow. It is grown chiefly for its oil, though the green plant is much used as a vegetable and as green meat for cattle. If sown separately, it is neither weeded nor manured, and seldom watered. It ripens in Phagan, the earliest of all the *rabi* crops except *toria ;* and the plants are picked out from the crop with which they are growing. The seed is called *bhakar*, and yields an oil which is the finest of all oils for burning, and is also good for cooking purposes, though inferior in this respect to that of *til*. The oilmen return one-third of the weight of seed in oil if yellow, and one-fourth if black, and keep the oil-cake. The *bhus* is called *turi*, and is worthless The plant is subject to the attacks of a gregarious red caterpillar (*al*) and is very sensitive to frost. *Rabi* oil-seeds.

Toria is an oil-seed (one of the *brassicas*), deriving its value from the rapidity with which it ripens. It is sown in Bhadon and ripens in Poh ; coming in just when oil is dear, and before

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the other spring oil-seeds have been reaped. Hence the proverb—

Toria hal joria, urdon choti bel,

Bhawen kitna bhagle, pakunga tere gel.

"The plough is yoked for the *toria*, when the *urd* creepers are already long.

But hasten as you will, I will ripen along with you."

Methi

Methi is a trefoil, used only as green fodder for cattle or as a pot herb. It is generally sown, sometimes with a little gram or *sirsam* mixed with it, between the cotton plants. Before the pods open, the ground is grubbed up with a hoe and the *methi* sown. It is watered the day after and again at intervals of 20 days or less as it needs a great deal of moisture. It grows very thick and close, and is cut green. It only yields one cutting.

Tobacco.

Tobacco is very generally grown in the villages, but mostly for private consumption only, except where local peculiarities are especially favourable.

The plant grows best in a nice loam soil, neither too stiff nor too open. A slight saline impregnation improves the plant; and the water of bitter wells or of the dirty village ponds, is best. Canal water is too pure. The land is ploughed 8 or 10 times, dressed most carefully, and laid out in ridges some 2 inches high and 8 inches apart, the seedlings being planted half way up the ridge on either side alternately and about 8 inches apart; for if water lies about the stem, it injures the plant. This is done in Magh or Phagan. They are then hand-watered with manure dissolved in water. Solid manure is generally used as a top dressing, as less is thus required. The dung of goats and sheep is the best, and old dry cow dung mixed with ashes. The field is watered every 10 days or so; and the hoe is then freely used so as to keep the earth about the roots open and the weeds removed. As the leaves grow they are sprinkled with *reh* or ashes to keep off insects and improve the flavour; and the flower-bearing pedicles (*go*) are nipped off as fast as they appear. The plant is ready to cut in Jeth. The whole plant is cut in the morning and left in the field for 24 hours to dry. Next day they are piled up and left to dry further. A hole is then dug and the plants are packed into it, covered up with *dhak* or *ak* leaves and left to ferment for five to ten days. The leaves (*pat*) are then stripped and either tied up into bundles (*juti*) or twisted into a thick rope. They are, if necessary, further fermented; and are finally dried and kept for

nse. When tobacco is wanted the leaves are cut up and powdered with an equal weight of *gur* in a mortar.

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The mixed crops proper are confined to the spring harvest, for the small pulses so commonly grown among the huge millets in the autumn are reaped and thrashed separately. In the spring, however, mixed gram and barley (*jachani*), wheat and gram (*jauchani*), wheat and barley (*gojí*) and all three mixed (*berra*) are commonly sown and reaped together, especially the twoformer. This custom has brought on the Indian cultivator much very undeserved hard language. It is true that the mixed grains have no export value, but then he does not grow them for export or even as a rule for sale. In one village the people complained that their Banias, to whom they were in debt, would not let them grow mixed grains The peasant devotes his best soil, his manured and irrigated fields, sown at the proper season and when neither too wet nor too dry, to the single grains which he will sell to his banker. In the remaining land he grows mixed grains which he eats himself, liking the varied flavour and especially finding the nitrogenous pulses an indispensable substitute for the animal food which religion or poverty forbids to him. Besides this, the three crops, which are sown together, flourish under different circumstances ; and a season which destroys one will very likely suit the other, and so gives a fair yield in the end. If it is rather late to sow gram alone, he sows gram and wheat ; and if the soil appears very wet, he will sow gram and barley. The damp will suit the barley, while if there are no Christmas rains it will save the gram. The frost which will kill the gram will spare the others ; while the dew on the gram leaves will help the wheat, and the wheat and barley will shelter the young gram from the sun.

Rotation of crops.

Such rules as are observed by the people regarding the rotation of crops are, of course, founded upon experience, and not upon scientific knowledge of crop foods and soils. But they have their reasons for them. The soil in which the spring crops are grown is called *dathoi* or *bhadwar*, according as it has or has not borne a crop in the autumn immediately preceding ; the former name from *datha*, a stalk, as the stalks are generally left in the hurriedly prepared ground ; the latter from Bhadon, the month in which they begin to plough the field. In single cropped land the chief consideration is the full utilisation of manure, care being taken to sow in land which has been heavily manured, and which will not have been exhausted by the single crop, only such valuable crops as must have manure to bring them to perfection. In

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double cropped land the nature of the crop to follow is chiefly determined by the date at which the autumn crop is cut, and the interval thus afforded for the preparation of the soil. Thus maize, which is cut early and always manured, is generally followed by wheat. Cotton is, for the same reasons, usually followed by cane, which is also often sown after *jowar*, manure being added. Cotton is often sown after cane or wheat; and wheat will often follow cotton or cane, with a season's interval. *Jowar*, which is very exhausting, is seldom followed by any spring crop except gram. Rice, except in Indri where nothing but rice is usually sown in rice land, is almost always followed by gram or mixed grains, the stiff wet soil being in many cases incapable of producing anything else, while the pulse following the cereal does not seem to suffer, judging from the crops often produced. And in the swampy canal villages, where the whole area is often too wet to grow anything but rice, barley is perforce sown in every field in the spring, not because there is much hope of a tolerable grain crop in the swampy fields, but because some sort of fodder must be had, and rice straw is of but little use. Manured land is never allowed to rest more than one season at a time, while the highly manured land close to the town will yield, with the help of vegetables and *china*, three or even four crops in the year.

Section B.—Rents and Wages.

Development of tenures.

The agricultural land of the district is for the most part in the hands of self-cultivating peasant proprietors. Sixty-nine per cent. of the cultivated area is so held, the proportion being largest in Kaithal, 78 per cent., and smallest in Thanesar, 52 per cent. The figures for Karnal and Panipat are 65 per cent each.

There has been little change in this respect since the last settlement. The partition of the Skinner estate in Panipat and Karnal was followed by the sale of practically all the villages owned by the family. In some cases the Jat and Arain tenants were strong enough to buy proprietary rights, in others the Skinners have been succeeded by Banias, members of the Mandal family or wealthy *zamindars*. The area of cultivated land held by rent-receiving landlords has been increased by grants of waste land to Civil and Military pensioners, while several estates formerly kept as grazing reserves by the Mandal and Kunjpura families have been opened to cultivation. The area held in occupancy tenure has naturally undergone little alteration. But the tenure of land by tenants-at-will paying-at-revenue rates is bound to diminish under the pressure of increasing population. Other tenants-at-will hold at cash rents or on rents represented