CHAPTER IX.

AGRICULTURE LIVESTOCK AND IRRIGATION.

General Condition.

Writing about the general condition in the old District Gazetteer of Gaya in 1906 Mr. O'Malley mentions :

" The average annual rainfall of Gaya is about 45 inches, but owing to the position of the district, it receives a full supply from neither monsoon, and the rainfall is frequently deficient, fitful or untimely. Besides this, the general slope of the country and the nature of the soil render the land very unretentive of moisture, and the local rainfall would therefore play a comparatively minor part in the agricultural industry of the district, were it not for artificial works of irrigation. Owing to the conformation of the surface, water is carried off so rapidly into the rivers that the artificial measures for storing water and leading it from the rivers by channels (locally known as *pains*) are indispensable. It is this necessity that has given rise to the network of *pains* and the thousands of artificial reservoirs, called *ahars*, which are scattered over the district; and it is on these sources of supply that the people almost entirely depend except in the west near the Son, where a considerable area is irrigated from the Patna-Gaya canal and its distributaries.

" As already stated the drainage flows northwards to the Ganges from the Chotanagpur plateau on the south, finding its outlet through a series of rivers and hill torrents, nearly all of which dry up after the rains are over. The district is thus divided into a number of parallel strips, each of which again slopes down to the river-beds on either side. The high land in the middle, which is known as *tanr*, is of poor fertility; it can only be irrigated from *ahars*, and grows chiefly *rabi* and *bhadoi* crops. This *tanr* land is most extensive in the south, but towards the north, where the surface is more level, the land is more easily irrigable. Most of the fields are supplied with the channels taking off from the rivers as well as from *ahars*, and the low lands near the rivers are generally sown with rice, which is the principal crop grown. "

Since that time no change except the deterioration in the canal condition due to disrepair has taken place.

Tracts of Fertility.

With regard to the tracts of fertility the following passages occur in the old District Gazetteer of 1906 which hold true more or less even to day :—

" The district of Gaya may be roughly divided into two tracts, that to the north well irrigated and fairly fertile, and that to the south sparsely populated, densely wooded and indifferently cultivated. The northern portion of the district, which constitutes about two-thirds of the whole area, is fairly level and is mostly under cultivation. In the

south the rise towards the hills of Chotanagpur is more rapid; the country is more intersected with hills and ravines; and the proportion of sand in the soil washed down from the hills is much larger. Cultivation in this tract is consequently much more scanty, and a large area is composed of hills and scrub-covered jungles extending for several miles below the hills.

" Though the district is divided broadly into these two large tracts, there are four minor subdivisions with different degrees of fertility. The first, or fertile tract comprises the Jahanabad subdivision and the western canal irrigated strip of the Aurangabad subdivision, the whole tract consisting of Jahanabad and Arwal thanas, and of a portion of Daudnagar thana. The western portion of this tract has the benefit of canal irrigation, while the northern and eastern portions are intersected by *pains* or irrigation channels leading from the rivers Morhar and Mohana. Moreover, the greater part of this portion of the district was once the basin of the Son river itself and the soil being largely composed of old alluvial deposit is naturally more productive than elsewhere.

" The second, or moderately fertile, tract consists of two areas, the first being composed of thanas Gaya, Tekari and Atri in the centre of the district, and the second of thana Nabinagar in the extreme south-west. These areas have also the benefit of ample irrigation from several rivers, and there are very few villages which have not either a *pain* or sub-channel (*bhokla*) leading off from some efficient source of water-supply.

" The third, or less fertile, tract also consists of two-areas—the first being the Nawada subdivision and the second the rest of the Aurangabad subdivision, consisting of thana Aurangabad and of a portion of thana Daudnagar. Only about half the villages in these two areas are sufficiently irrigated, and moreover, the *pains* that do exist only give an adequate supply of water in years of good rainfall.

" The fourth, or infertile, tract consists of thanas Sherghati and Barachatti, or the southern half of the headquarters subdivisions. Besides containing extensive tracts of jungles, there are few *pains*, and only about ten per cent of the villages are irrigated. Hence paddy is little cultivated, as compared with the rest of the district, and is liable to failure in a moderately bad year. "

Soil.

In the old District Gazetteer under the head Soil Mr. O'Malley writes :

" In the northern tract the soil is generally alluvial, consisting chiefly of *pauru*, a loam with a small proportion of sand, and *kewal*, a species of hard stiff clay, opening out, when dry, in gaping fissures, which make cross-country riding impossible. In the south a great part of the existing sub-soil has been deposited by diluvion from the hills, the rivers issuing from which carry along with them quantities of hard

white and yellow sand; this accounts for the large proportion of sand in the soil and for the large areas which are almost entirely composed of sand. This sandy soil is called *balwat*, *balmat* or *balsundri*. In some places also there is a white soil called *rehra*, which is rendered more or less useless by being impregnated with carbonate of soda; when the impregnation is so great as to render it unculturable waste, it is known as *usar*. The presence of carbonate of soda (*reh*) in paddy land does not, however, seem to make it infertile, the soda being presumably dissolved by the water. *Pauru* soil is best adapted for the cultivation of paddy, though in the area irrigated from the canals even sandy soils produce fine paddy; it requires irrigation, and gram is almost the only crop that can be raised without it. *Kewal* clay is best suited for *rabi* crops, as it retains moisture longer, and the *rabi* has to depend to a great extent on sub-soil moisture."

The average yield of *rabi* grown in *kewal* clay varies between 6 to 9 maunds per acre and that of paddy grown in *pauru* and sandy (where irrigated) soils varies between 8 to 9 maunds. The *tanr* land irrigated by *ahars* are fit for rabi and *bhadoi* and its yields vary between 5 to 6 maunds per acre.

Chemical Analysis of Soil with Special Reference to Fertility.

The soil rich in nitrogen and calcium is in the fertile tract composed of old alluvial deposit found in Jahanabad and Nabinagar. The soil containing nitrogen and phosphorus in fairly good quantities as well as lime with gravels is considered moderately fertile. Such soil is found in the Sadar subdivision. The soil poor in nitrogen and phosphorous having sufficient lime and at places carbonate of soda is called *balsundri* or less fertile soil and at places *usar* especially where carbonate of soda is found in sufficient quantity. The soil extremely deficient in nitrogen and organic matter is the most infertile soil mostly found in Sherghati and Barachatti areas.

The soil of the different tracts of land of the district has been chemically analysed. The result of analysis is given below :—

Place	Location.	Nitrogen per cent.	P_2O_5 per cent.	K_2O per cent.	PH per cent.
1. Barwam ..	8 miles north-west of Nabinagar.	0·05—0·07	·003—·026	·008—·015	6·0—6·
2. Siris ..	Farm	0·06	0·05	·007	8·2—8·7
3. Chauram ..	9 miles south-west of Arwal.	·010—·085	·013—·057	·010—·031	6·4—7·0
4. Pauthus ..	12 miles south-east of Daudnagar.	·023—·055	·003—·007	·011—·030	6·8—8
5. Qazisaray ..	6 miles south-east of Jahanabad.	·020—·090	·014—·029	·006—·021	8.4—8·8
6. Khijirsaray	9 miles north of Gaya	·042—·062	·002—·018	·004—·620	6·0—6·0
7. Gaya ..	Farm	·045—·051	·001—·004	·013—·021	..
8. Barachatti	3 miles south-east of village.	·030—·053	·002—·016	·006—·052	6·4—8·2
9. Near Nawadah.	3 miles north-east of Nawadah.	·039	·014	·027	6·0
10. Goplakalan	8 miles from Gaya..	·053—·067	·015—·030	·012—·021	6·6—7·4

Soil Erosion and Silting.

Soil erosion varies directly with the slope of the land. The more is the slope greater is the erosion. The topography of the district is slopy. The drainage flows to the north of the district and transports the eroded soil into the Ganges. Wind erosion is also caused due to lighter soil. Deposits of such erosions are found on the banks of Phalgu and Son rivers. The erosion is being checked by sowing cover crops of legumes by contour ploughing, by string cropping and by planting more trees.

SEED.

Paddy.

A description of the varieties of paddy which are mostly grown in the district of Gaya is given below :—

Bihar Kolaba (*B. R.* 1).—It is a selection from Kolaba paddy which was originally imported from Bombay. It is sown either by broadcast method or by transplantation method. Under transplanted condition it yields 2,132 to 2,466 lbs. (26 to 30 maunds) per acre. It takes about 90 days after sowing to flowering. When sown in the month of June and transplanted in the middle of July, it flowers in the middle of September and is harvested latest by the middle of October. The husk is straw coloured and awnless. The rice is fine measuring 5.6 mms. in length and 1.8 mms. in breadth.

Aman Paddies.

115 *B. K.* (*B. R.* 3).—It is a selection made from *dahia*. It is an early ripening *aman* paddy. When sown at the end of June and transplanted at the end of July it flowers in the second week of October and is ready for harvest in the end of November. It yields about 2,050 to 2,460 lbs. (25 to 30 maunds) per acre which is about 10 per cent over the standard variety of *dahia*. The husk is awnless and golden yellow with black furrows. The rice is white and medium, measuring 5.9 mms. in length and 2.1 mms. in breadth. It is non-lodging. This variety generally suits all tracts of the district.

36 *B. K.* (*B. R.* 7).—It is a selection from the local variety of *kessore* of Bhagalpur district. It is a late maturing *aman* paddy. When sown at the end of June and transplanted at the end of July, it flowers in the last week of October and is harvested in the second week of December. The average yield per acre is 2,460 to 2,870 lbs. (30 to 35 maunds) showing an increase of 20 to 25 per cent over the standard variety of the class. The husk is straw coloured with awns up to the length of 1 to 3 mms. The rice is medium measuring 6.8 mms. in length and 2.1 mms. in breadth. The variety is suitable for all tracts of land in the district where late local varieties are grown.

Besides these certain local varieties are also grown in the district.

Wheat (Triticum sativum).

Mainly two varieties of wheat are grown in the district.

Barley (Hordium vulgara).

No improved variety of barley is grown in the district.

Maize (Zea mays).

Out of the two improved varieties of maize, Jaunpur and Kalimpong, generally Jaunpur variety is grown in the district.

Gram (Ciur arictinum).

Out of three varieties of superior grams, viz., BR-17, BR-65 and BR-77, only BR-65 and BR-17 are grown in the district.

Pea (Pisum sativum).

Mostly three varieties, namely, BR-118, BR-2 and BR-12, are grown. First two varieties are suitable for fields.

Arhar (Cajanus cajan).

Arhar has been classified according to maturity, that is, early maturing, medium maturing and late maturing. BR-13, BR-59 and BR-172 are early maturing *arhars;* BR-60, BR-65 and BR-71 are medium maturing and BR-15, BR-75, BR-10 and BR-17 are late maturing.

Khesari (Lathyrus sativus).

Three varieties of *khesari*, namely, BR-3, BR-13 and BR-14, are generally sown.

Seeds of four different types leguminous weeds have been observed in the trade samples of *khesari* in various proportions. They are :—

(*i*) *Akta (Vicia sativa).*
(*ii*) *Pipra (Lathyrus aphœa).*
(*iii*) *Laugri Khesari (Lathyrus sphœricus).*
(*iv*) *Misya (Vicia hirsuta).*

MANURE.

In the old District Gazetteer Mr. O'Malley remarks that no other manure than cowdung and household refuse were in use. Even the cowdung was not rich in manurial constituents due to poor food to the cattle. The negligent manner in which it was stored also diminished its value. Moreover, due to scarcity of fuel it was burnt in many parts of the district. The manure was generally used for paddy, potato, sugarcane and other garden produce.

Since last 30 years the system of manuring has undergone a rapid change. Cultivators have now taken to the preparation of compost from the cowdung. Compost is considered as a most important manure. Cultivators near the town area also use the compost prepared from night-soil or human excreta. Artificial or chemical manures like ammonium sulphate, superphosphate and bonemeal are now also used extensively in the district.

Determining the magnitude and the type of manure needed by a particular kind of soil are prerequisite to the actual application of chemical manure. For this two methods have been evolved, namely, (*i*) chemical analysis of soil; and (*ii*) field manurial experiments on the Government Experimental Farms.

In the absence of proper soil map with accurate soil boundaries, the simple experiment on the fields of cultivators has been done. Each experiment plot consists of a number of sub-plots of one-tenth acre each and different treatments are tried on these. In 1948-49 the number of treatments was 4, in 1949-50 it was raised to 6 and in 1950-51 it was further raised to 7. As it was found that only 6 treatments per cultivator's plot could be efficiently managed the treatments were reduced to 6 in 1951-52 and 1952-53.

The following is the manurial schedule :—

Paddy.—Ammonium phosphate at 2 maunds 14 seers per acre. This gives an extra yield of 10 to 12 maunds with profit of Rs. 70 to Rs. 100.

Maize.—Ammonium sulphate at 2½ maunds per acre. This gives an extra yield of 10 maunds with profit of Rs. 40 to Rs. 80. In Sherghati area ammonium phosphate at 2 maunds 14 seers produced good result.

Wheat.—Ammonium phosphate is to be used at 2 maunds 14 seers per acre. This gives an extra yield of 6 to 12 maunds with profit of Rs. 100 to Rs. 250. In Daudnagar area ammonium sulphate at 1 maund 35 seers per acre and in Arwal and Nawada areas at 2½ maunds produced good result.

Gram.—Single superphosphate is to be used at 3 maunds per acre. This gives 36 maunds of extra yield with profits of Rs. 25 to Rs. 70. In Arwal area a smaller dose of 2 maunds 10 seers is considered adequate.

Agricultural Implements.

The agricultural implements used in the district have not undergone any appreciable change. The same primitive wooden plough is still generally used by the cultivators. Certain new type of agricultural implements like Bihar Plough, Bihar Cultivator and Bihar Ridging Plough are also being used in the district but to a very limited extent.

Tractors are also used by certain interested cultivators in the district. Other kinds of agricultural implements are *kudal*, *khurpi*, sickle, beam, etc.

Use of the primitive plough does not attain necessary tilth in the soil. The cost per acre comes to nearly Rs. 13-3-0 only if ploughed to a depth of 6 inches in medium soil. The cost of ploughing by tractor comes to Rs. 5.

Though the cost of ploughing by tractor is much lower than the indigenous plough, still the former is not commonly used. The main reasons for it are the poverty of the cultivators, small and scattered holdings, difficutlies of repair and replacement, heaviness of the implement, scarcity of trained personnel and last but not the least the mentality of cultivators.

Principal Crops.

In the old District Gazetteer Mr. O'Malley writes: " The crops grown in Gaya are divided into three great divisions, the *aghani*, *bhadoi* and *rabi* crops. The *aghani* is the winter crop of rice which is cut in the month of *Aghan* (November-December); the *bhadoi* is the early or autumn crop, reaped in the month of *Bhado* (August-September), consisting of 60-day rice, *marua*, *kodo* Indian-corn, millets and less important grains; while the *rabi* crop, which is so called because it is harvested in the spring (*rabi*) includes such cold-weather crops as gram, wheat, barley, oats and pulses. "

Since then no important change except in the area occupied by the different crops has taken place.

Rice.

Aghani Rice.—In the old District Gazetteer Mr. O'Malley mentions: " Rice which occupies a normal area of 13,38,330 acres, is the staple crop of the district. The *aghani* or winter rice forms the greater part of this crop, and is raised on over 13,18,000 acres. It is sown broadcast after the commencement of the rains in June or July on lands selected for seed nurseries, which have previously been ploughed three or four times. After four or six weeks, when the young plants are about a foot high, they are generally transplanted; each plant is pulled out from the land, which is soft with standing water, and planted again in rows in flooded fields, in which the soil has been puddled. After this the rice is left to mature, with the aid of water, till towards the end of September. The water is then drained off and the fields are allowed to dry for 15 days, and at the end of that time they are again flooded. It is this practice, known as *nigar*, which makes the rainfall, or failing that, irrigation essential to successful harvest. These late rains (the *Hathiya*) are the most important in the year, as not only are they required to bring the winter crops to maturity but also to provide moisture for the sowing of the *rabi* crops. Should no rain fall at this period, or if water cannot be produced from artificial sources, the plants will wither and become only fit for fodder; but if seasonable showers fall or the crops are watered from *ahars*, *pains* or canals, the rice comes to maturity in November or December. " At present (1953-54) the total area on which the rice is grown comes to 11,74,387 acres. The *aghani* or winter rice is grown on 11,61,560 acres. This shows an enormous fall in the area under rice. It is difficult to account for the fall. But it may be said that till recent years the system of collecting statistics was somewhat faulty. It may also be mentioned that the system of *pains* and *ahars*, which was excellent at the time of

Mr. O'Malley has gone out of order and the agriculture has been to a great extent left at the mercy of the vagaries of monsoon.

Other kinds of rice.—Mr. O'Malley further mentions: " Some winter rice known as *baog* is not transplanted; it is sown broadcast on low lands at the commencement of the rains, and also in years in which there has not been sufficient moisture to allow of transplantation at the proper time. The *bhadoi* rice, which covers 20,000 acres is also sown broadcast in June or July and not transplanted; it is regarded as a 60-day crop, and is generally harvested in August or September. There is another kind of rice, known as the *boro* or spring rice, which is sown in January, transplanted after a month and cut in April. It is grown only on marsh lands and in the beds of shallow streams, and the area cultivated with it is insignificant. "

Mr. O'Malley further mentions:

" A noticeable feature of rice cultivation is the way in which it is conducted religiously according to lunar* asterisms (*nakshatras*). The seed-beds throughout the country are, if possible, sown within a period of 15 days, called the *Adra nakshatra*, which lasts from about the 20th June to the 5th July. Transplantation from the seed-beds goes on during the *Punarbas*, *Pukh* and *Asres nakshatras* (18th July—15th August). The water on the fields in which the young plant has grown up after transplantation is regularly drained off in the *Utra nakshatras* (12th—25th September)—a period when as a rule, there is little rain; and after the exposure of the soil to the air and sun, the usual heavy rain of the *Hathiya nakshatra* (26th September—7th October) is awaited. After this, it is the universal custom to keep the fields wet during the *Chitra nakshatra* (8th—20th October), and at the commencement of the *Siwati nakshatra* (21st October—3rd November) they are again drained, and the paddy is left to itself till the *Bisakha nakshatra* (4th—15th November) when it is cut.

" Although there are sometimes slight variations in the times of sowing and transplanting from those given above, yet the cultivators are always extremely strict in draining off the water from the fields in the *Utra nakshatra*. It may be said that every cultivator begins, if he possibly can, to let off the water on the first day of that *nakshatra*, and this is done without any hesitation, in the country commanded by the canals because the cultivators look to the Irrigation authorities to supply them with water, whether the *Hathiya* rain fails entirely or not. It is generally agreed that after this draining (*nigar*) rice plants cannot exist for more than from 15 to 20 days, unless watered, without rapid deterioration; and as no ryot will, under any circumstances, take water till the *Hathiya nakshatra* has commenced the Canal Department is called upon to irrigate within a very few days every acre under lease. If water is delayed a week after it is wanted

*As the *nakshatras* are calculated according to phases of the moon, they vary slightly from English dates, but the greatest variation is only of five days.

at this stage, the crop suffers; if it is delayed three weeks, it withers beyond redemption. "

Observations of Mr. O'Malley have not undergone any change nor they are expected to see any change unless some great innovation is made in the method of cultivation or in the varieties of crop cultivated. However, it may be mentioned here that the Development Department has taken interest to popularise the Japanese method of cultivation and has demonstrated the method on some selected plots of land. The yield has been found to be satisfactory. But under this method also the rule of *nakshatra* has more or less got to be observed.

Bhadoi Crops.

Writing about *bhadoi* crops Mr. O'Malley states :

" The *bhadoi* crops require plenty of rain with intervals of bright sunshine to bring them to maturity and constant weeding is necessary for a good harvest. The time of sowing depends on the breaking of the monsoon; if the rainfall is early, they are sown in the beginning of June; but they can be sown as late as the middle of July without the prospect of the crop being lost. Harvesting usually extends from the 15th July to the 15th October.

" The principal *bhadoi* crop is *marua* (*Eleusine corocana*), a valuable millet, occupying a normal area of 77,000 acres, which is sown at the commencement of the rainy season and cut at the end of it. It is partly sown broadcast and partly transplanted to ground that afterwards gives a winter crop. The grain is largely consumed by the poorer classes in the form of *sattu*, or is converted into flour and made into a coarse bread; in bad seasons when the rice crop fails, it supports the people till the spring crops have been harvested.

" Next in importance to *marua* comes maize (*Zea mays*) or Indian corn (*makai*), which is raised on 63,000 acres; it is sown from the 20th June to the 20th July and cut from the 15th July to the 15th August. Besides being consumed in the form of bread or as *sattu*, the young ears while still green are often parched in the cob, and so eaten. Among millets *jowar* (*Sorghum vulgare*) is grown on 19,000 acres, and *kodo* (*Paspalum scrobiculatum*) is a favourite crop sown on poor lands early in the rains and reaped after they are over. It is millet cheaper than rice, which is popular with the poorer classes as it can be readily grown on an inferior soil; it is eaten boiled like rice or sometimes in *chapatis*, but is not very nutritious. The chief oil-seed grown at this time of the year is *til* or gingelly (*Sesamum indicum*) which is sown in July and reaped in September; its total acreage is about 10,000 acres. The castor oil plant (*Ricinus communis*) is sown from the 20th June to the 1st August and is cut from the 29th December to 30th April. "

Since then no noticeable change excepting in the acreage of land occupied by different crops has taken place. At present (1953-54) *marua* occupies 17,779 acres, maize 33,373 acres and *til* or gingelly 4,295 acres.

Rabi Crops.

While writing about *rabi* crops Mr. O'Malley mentions in the old District Gazetteer :

" Ploughing of the fields for the *rabi* crops commences early in the rains and is continued at convenient intervals, sufficient time being given to allow the upturned soil to be exposed to the air. In the case of clay soils in unirrigated parts more frequent ploughing is necessary for all *rabi* crops because otherwise the soil would become so hard that if there was no rain at the sowing time, a crop could not be sown. The time of sowing *rabi* is generally regulated by two circumstances—the heavy rains of the *Hathiya nakshatra* (26th September to 7th October) and the approaching cold season. If sown too late, the plants will not become strong enough to resist the cold; if sown too early, the heavy rain will probably drown the seed and sprouting crop, and so necessitate the re-sowing. The cultivators are thus anxious to sow as soon as the heavy rains have ceased and the general rule is that the proper time for sowing most *rabi* crops is the *Chitra Nakshatra* (8th to 20th October), and that it must not be delayed beyond the *Siwati nakshatra* (21st October—3rd November). A sufficient supply of water is essential at this time; later on several waterings are required, and if there is no rain, the crops have to depend on well irrigation. They are finally harvested between the last week of February and the middle of April.

" The most important of the cereals is wheat, which occupies altogether 1,34,000 acres. It is generally sown broadcast on sandy soil, and requires as a rule four waterings. It is frequently sown on lands from which a crop of early rice has been taken, and is often sown together with barley or with gram, mustard or linseed. The stubble is grazed by cattle, and the pounded straw (*bhusa*) is used as fodder. About half the area under wheat, or 70,000 acres, is occupied by barley (*Hordeum vulgare*), which is sown partly with wheat, partly by itself and partly with pulse. Like wheat, barley is sown broadcast and requires four waterings.

" The other great class of *rabi* crops consists of pulses, of which, gram or *bunt* (*Cicer arietinum*) is by far the most extensively grown as a normal area of 96,000 acres is given up to it. Besides forming an excellent fodder for fattening horses, this pulse is eaten by the natives in all stages of its growth. The young leaf is eaten, and the grain is split and converted into *dal*, or pounded into *sattu*. Among other crops may be mentioned peas, the china millet (*Panicum miliaceum*), *kulthi* (*Dolichos biflorus*) and various pulses and lentils, such as *rahar* (*Cajanus indicus*), *masuri* (*Ervum lens*) and *khesari* (*Lathyrus sativus*). The crop last named is frequently sown broadcast among the rice stubble. It requires no care and the grain is eaten, in the form of *dal* or as flour cooked in *ghee*, by the poorer classes. If eaten in excess, it produces a form of paralysis known as lathyrism. "

Oil-seeds.

Regarding oil-seeds O'Malley observes as follows :

" The oil-seeds occupy an important position among the *rabi* crops. The chief is linseed (*Linum usitatissimum*), which is grown on a normal area of 80,000 acres. It now forms one of the chief articles of export, and every year many thousands of maunds are sent out of the district. The other principal oil-seeds are mustard and rape which are raised on 22,000 acres. "

The observations of Mr. O'Malley in the above paragraphs still hold more or less true. At present (1953-54) wheat is grown on 186,655 acres, barley on 41,908 acres, gram or *bunt* on 211,486 acres, linseed on 41,812 acres, and mustard and rape on 7,508 acres.

OTHER CROPS.

Cotton.

Regarding cotton O'Malley mentions :

" The fibre crops of Gaya are inconsiderable, the normal area under cultivation being only 1,000 acres. Thirty years ago the cultivation of cotton was carried on to a considerable extent in the Jahanabad subdivision, and also in the Nawada subdivision and to the west of the district about Daudnagar; and in the beginning of last century it was much more extensive, as the cloth factories at Jahanabad, Daudnagar and elsewhere created a demand for the raw product. The local cotton industry has now been ruined by the competition of imported piece-goods, and the area under cotton has shrunk till it now amounts to only 300 acres. " No cotton is grown now in the district.

Indigo.

Mr. O'Malley further writes : " Indigo is another crop the cultivation of which has been practically abandoned, though it has never really flourished in Gaya. In 1812 Dr. Buchanan Hamilton wrote that indigo was of little importance and its cultivation was on the decline. Later, however, European enterprise took up the industry, and several factories were established in the west of the district. There were a large indigo concern at Sipah, commonly known as the Arwal Concern and a factory at Tararh near Daudnagar, with out-works at Pura, a hamlet of Kaler village on the Son, and at Baghoi on the banks of the Punpun, the whole being known as the Daudnagar Concern. The industry with difficulty survived the Mutiny, when all the factories were dismantled and the labourers dispersed, and from that time its growth rapidly declined until 1878, when the introduction of the Son Canal system converted the poorest lands in this part into the most fertile. Indigo was then entirely dropped giving way to Zamindari management, a safer and more profitable undertaking. The cultivation is now practically extinct, and indigo is grown only on 100 acres. " The cultivation of indigo has now been totally abandoned.

Opium.

When the old District Gazetteer was being written, cultivation of poppy was considered as the most important as not only was the normal area under the plant considerable (51,000 acres), but the price obtained for the crude opium rendered it a very valuable crop. The opium was grown only on Government account.

Mr. O'Malley further remarks in the old District Gazetteer: " There is a tendency for the cultivation of poppy to decrease as year by year it is becoming less profitable to the ryots. Cultivators were gradually taking to the cultivation of sugarcane, potatoes, chillies and vegetables. This process was further quickened by the fact that the value of cereals has increased in recent years while the price paid for crude drug remains stationary, and in the decade ending in 1903-04, the area under poppy has decreased in the Gaya Sub-Agency from 58,900 *bighas* to 41,000 *bighas* and in the Tehta Sub-Agency from 42,900 *bighas* to 41,000 *bighas*. " The cultivation of poppy has now been completely abandoned.

Sugarcane.

In 1884 less than 13,000 acres were estimated under this crop. The acreage rose to 30,100 in 1904-05. The increase is partly due to introduction of Son Canal system in the west of the district. The industry got another stimulus by the introduction of iron roller mills worked by bullock power, invented by the proprietors of Bihia estate in Shahabad in 1874 and hence known as Bihia mills. In spite of the conservatism of cultivators, the new machine got popularity and the old-fashioned appliances which necessitated the cutting up of the cane and extracted a fraction of the juice was not in use during the time the old District Gazetteer was being written. A sugar factory of 850 tons was established in 1933 at Guraru. This gave another fillip to the industry. The area under cultivation of sugarcane was 27,224 acres in 1953-54. The acreage has declined, but efforts are being made to increase it.

Recently the Department of Agriculture has introduced a scheme for cane development in the district. The area in which the scheme has been introduced comprises of reserved areas of the Rohtas Industries, Ltd.; the Sugar Factory, Dalmianagar and the Gaya Sugar Mills, Ltd., Guraru and also the area in the vicinity of Warsaliganj. The target fixed for the organisation for five-year period beginning from 1952 is 20 tons of sugarcane to the acre, 12 per cent sugar in bags and 120 days' crush against the present 14 tons per acre sugarcane, 10 per cent sugar and 95 days' crush.

It is hoped that this new scheme for the development of sugarcane will further add to the development of sugarcane cultivation in the district. The acreage under this crop will also increase.

Sugarcane is considered as one of the most profitable crops grown in the district. It is a crop which not only exhausts the soil, but

occupies the ground for a long period, extending over a year. It is planted during February or March in cuttings of about a foot in length placed in rows about 2 feet apart. When the plant begins to sprout, it is well watered and the surrounding earth is loosened. Each plant grows into a cluster which are generally ready for cutting in January or February. The crop requires great care, and must have 7 or 8 waterings, even if other crops have to do without water in consequence.

Vegetables and Fruits.

The soil being mainly clayey, there has been little scope of orcharding. However, mangoes, plums, guavas and orange are cultivated in some areas. Of the other cultivated fruits, the commonest are the plantain, litchi, jack-fruit, custard apple and *bel* fruit. The *khajur* tree is cultivated abundantly for the sake of its juice, which is made into liquor; and the *mahua* flower is used for the manufacture of country spirit, and is also eaten by the poorer classes, especially by those living near the jungles. The cultivation of the climbing vine *pan*, the leaves of which are chewed with *supari* or areca-nut is carried on to a considerable extent at Ketki and some neighbouring villages in the Aurangabad subdivision, and at Tungi and Deodha in the Nawada subdivision.

Among vegetables, potato is leading, having an acreage of about 7,000. Onion, lady's finger, cauliflower, tomato, cabbage, carrot, brinjal, turnip, ground-nut, pumpkins, gourds, yams, cucumbers and melons are also cultivated. Among condiments the favourite is the chilli, but turmeric, coriander and ginger are also grown.

The acreage under the above can be increased with the possibilities of assured irrigation in many of the areas. Special efforts have to be made to concentrate on citrus particularly orange for which there is enough scope in this district. Top working of plums and planting buddled citrus plants will go a long way to help the plantation. Attention has also to be given to other important fruits like banana, guava, and pine-apples, which can be made to grow with some efforts.

Use of better seeds and assured irrigation are the key points for increasing the area under vegetables. There is a very good scope of increasing the area under potato and onion for market supply. These are already being grown extensively now. Facilities of cold storage is helpful in this direction.

Figures mentioned below show the area occupied by fruits and vegetables in the district :—

Fruit Orchards (1955-56).

Area in acres (State figures within brackets).

Mango—900 (217,517).	Plums—500 (6,000).
Banana—400 (20,800).	Orange—56 (1,084).

Vegetables.

Area in acres (State figures within brackets).

Potato—7,000 (53,550).	Cabbage—42 (584).
Onion—1,390 (23,489).	Carrot—52 (1,004).
Cauliflower—345 (6,749).	Turnip—128 (1,745).
Tomato—55 (5,119).	Okra (I. F.)—375 (5,100).

LAND IMPROVEMENT AND AGRICULTURAL LOANS.

In the old District Gazetteer Mr. O'Malley has remarked that loans under the Land Improvement Loans Act were taken by the people with fair readiness and that the amount advanced under the agriculturists' loans was comparatively small. The latter was devoted to the purchase of seed and cattle and the former to the improvement of extension of the means of irrigation such as the maintenance and repair of artificial embankments, water channel and reservoirs. The following table will show the total amount advanced in 1947-48 to 1951-52 :—

	Land Improvement. loan.	Agriculturists' loan.
	Rs.	Rs.
1947-48	1,000	1,000
1948-49	... 42,000	1,07,340
1949-50	... 32,530	90,550
1950-51	... 90,650	1,38,330
1951-52	...1,26,065	13,01,850

Sand clearance loan is also given to the agriculturists to clear sand from fields and make them cultivable, where possible.

EXTENSION OF CULTIVATION.

" In 1876 the cultivated area was estimated as 17.28 and the uncultivated as 14.19 lakh acres. The average net area cultivated during the five years ending 1904-05 was 17.27 lakh acres. The Final Report of the Survey and Settlement Operations (Gaya), 1911—1918 gives the net cultivated area as 18.29 lakh acres and current fallows as 1.37 lakh acres, comparison with the 1951 figures (based on average for five years preceding 1951) shows that in the intervening period, 2.03 lakh acres of land have been brought under cultivation. The culturable waste which was 4.39 lakh acres at the time of Settlement has been reduced now to 1.64 lakh acres or by 2.90 lakh acres. As the extension of area under cultivation accounts for only 2.03 lakh acres, the remaining 87,000 acres must have been utilised for construction of houses, aerodromes, etc. The area under current fallows has increased as compared with Settlement figures by 69 thousand acres. The reason is that the land newly brought under cultivation is mostly marginal land which cannot be cultivated profitably every year. The 1.64 lakh acres shown under cultivable waste consists mainly of—(1) bush jungles in the south and east of the district which considering the high

slope of the country cannot be reclaimed in many cases without starting a process of rapid soil erosion over extensive areas, and (2) small bits of village common (*gairmazrua*) scattered all over the district which serve essential village needs. Generally speaking, therefore, the scope for further extension of cultivation is very limited. " (District Census Hand-Book, Gaya, 1952).

Size of Holdings.

The description of every thousand agricultural holdings in the Gaya district by size is as follows :—

Upto 50 cents—26.2 per cent.
Upto 1 acre—13.6 per cent.
Upto 2 acres—14.5 per cent.
Upto 3 acres—10.5 per cent.
Upto 4 acres—9.2 per cent.
Upto 5 acres—5.5 per cent.
Upto 10 acres—12.4 per cent.
Upto 15 acres—3.2 per cent.
Upto 30 acres—3.6 per cent.
Upto 50 acres—1.0 per cent.
Exceeding 50 acres—0.3 per cent.

Irrigation.

System of Irrigation.

Topography, soil and scantiness of total rainfall with its irregularity are the chief causes which have led the people of the district to devise a system by which the natural course of water in the river is impeded and utilised for cultivation. Writing about irrigation in the old District Gazeteer of 1906 Mr. O'Malley states :

" The agricultural prosperity of Gaya depends in a unique degree on an extensive system of artificial irrigation. To the north-east the cultivators have the benefit of the Son Canals and are thus certain of an ample and regular supply of water, but elsewhere the people are dependent on methods of irrigation which have been practised from time immemorial. This indigenous system is the outcome of the natural conditions and physical configuration of the country, and has been evolved to meet the obstacles which they place in the way of cultivation. The district is characterized by a scanty rainfall, a rapid slope off which the water quickly runs, and a soil which is either a stiff clay or a loose sand equally unretentive of moisture. To a *ryot* of Eastern Bengal the country would seem utterly unsuited for rice cultivation, both from the nature of the surface and the comparative scantiness of the rainfall. But both difficulties have been overcome by the ingenuity and industry of its inhabitants, who have devised a system by which the natural drainage is blocked and the water impounded for use and have also brought the rivers into their services by diverting the water they bring down.

" The district is bounded on the south by the high lands of the Chotanagpur plateau and the spurs which project from it, and along the northern boundary it marches with the low-lying plains of the Patna District. The general slope is accordingly from south to north towards the Gangetic valley, and it is comparatively rapid, the average fall northwards being about six to four feet in the mile. A number of wide rivers debouch from these southern hills and intersect the district as they flow across it from south to north. They are swollen torrents after heavy rainfall in the hills but the slope of the country is so great and their beds are so sandy, that the water is rapidly carried through the district or it percolates down through the land. In order therefore to prevent the water being wasted in this way, long narrow artificial canals, called *pains* are led off from the rivers, by means of which the river water is conveyed to the fields. The same rapid slope would also prevent the land from gaining the full benefit of the rain water were it allowed to flow unchecked; and the cultivation of the rice crop on which the people almost entirely depend, would be impossible, if the water were not impounded in extensive reservoirs, called *ahars*, which are formed by constructing a series of retaining embankments across the line of drainage. The whole forms a most remarkable and ingenious system of artificial irrigation, which is admirably supplemented by the manner in which the water is distributed from field and retained in them by a network of low banks. In the cold weather, again, when the *ahars* have dried up and the *pains* no longer contain water, the people can fall back on their wells; and thus the crops are protected from failure throughout the year. "

An opinion somewhat contrary to the view expressed above was expressed by the Collector of Gaya (1947—1949) in the following words : " the recurrence of floods in the Gaya and the Patna districts with the existence and characteristics of the private irrigation system in the Gaya district has not been adequately appreciated. In my opinion the peculiar irrigation system was developed in Gaya district with the object, *inter alia*, to minimise the rush and speed of the flood water which owing to the proximity of the hills and the existence of spurs even in the plains, would otherwise be overwhelming. Catchments, services of embankments, diversionary channels (*pains*) and reservoirs, all these bring blessing not only to the crops but also do what a thick jungle does elsewhere, viz., holds back the water. So long as these minor irrigation works in the Gaya district were kept in a reasonable state of repair, floods in the lower regions of Gaya and Patna districts were well under control. Whenever, there had been negligence devastating floods had followed. In 1888-89 owing to the impoverishment the landlords were unable to keep the embankment in good order. In 1888 a violent flood swept away the weakened banks particularly in the Nawada subdivision. Similarly during the last 10—15 years owing to various reasons the irrigation works have been greatly neglected. The floods of 1946 and 1948 have been largely due to the weakening of the irrigation works. They are bound to become a recurrent feature

unless the irrigation works in the Nawada and Aurangabad subdivisions are strengthened "

Pains.

Writing about *pains* Mr. O'Malley writes :

" The rainfall being often scanty and untimely, the system of *pains* has been devised in order to make the most of the scanty supply, by utilizing the rivers for the purpose of cultivation. The rivers of Gaya have only a fitful flow; they may fill for a few days and be almost empty for the next fortnight, and then fill again with a day or two's rainfall; but by means of these artificial channels the cultivators secure all the water they bring down. Roughly one-third of the total irrigation of the district may be said to be derived from *pains*.

" They are led off from a point facing the current of the river, some way upstream above the level of the land they are intended to irrigate; and it is often 2 or 3 miles before the water of the *pain* reaches the level of the cultivation. Some are large with many distributaries and some small with few or no distributaries. They are sometimes as much as 10, 12 or even 20 miles in length, and some of them irrigate hundreds of villages. The largest *pains* that feed a number of distributaries and irrigate many thousand acres are known as *dasiain pains*, i.e., literally *pains* with 10 branches. The main channels are known as *pains* and the smaller channels taking off from them are called *bhoklas*, while the smallest channels that lead immediately into the fields are known as *karhas*. Where level of the country permits, the water is led into the fields from these *pains* and *bhoklas* by means of the *karhas*, but where the level of the water in *pain* or *bhokla* is below that of the fields on either side, the water is raised by some of the artficial means in use in this part of the country, such as the *lath kunri* or lever and bucket, the water basket called *chanr* or *sair*, and the *karin* or wooden canoe-shaped lift.

" During the rainy season from July to September, the *pains* are full and flow well, but as the rains cease and the rivers dry up, the water has to be led into the *pain* by means of training works known as *derhiain* or *baluain*. In a year of scanty rainfall or when the rain has been untimely, these *pains* are of the greatest importance for the rice crop and the sowing of the *rabi*. Should there be no rain at the time of the *Hathiya nakshatra*—that most critical period of the year when water is absolutely essential to fill out the ripening grain, a sudden activity is at once seen in the rivers. Training works are vigorously pushed on at the heads of the *pains* to try and lead into them every drop of water left in the beds of the rivers; and the more wealthy landlords cause *bandhs* to be erected at customary places to block up water therein and thus give it a head into some *pain*.

" These channels have been constructed by the landlords who are also responsible for their maintenance—a work which entails considerable expense, as the *pains* quickly silt up, owing to the sandy nature

of the river beds, and have to be cleared out every year or two. Ordinary petty maintenance, however, such as the periodical clearance of silt, the repair of small breaches, etc., is done by the cultivators themselves under the *goam* system. At the order of the landlord or his local agent or servant, the cultivators have to supply one man per plough to turn out on these occasions and carry out the work; the peasants come in a body, and this is called a *goam*.

" The *pains* are essentially private canals, and in the case of the more important which serve many villages, each village has its fixed turn of so many days and hours to use the water, these turns being assigned by mutual agreement or ancient custom. This distribution of the right of irrigation by turns (*para*) is known as *parabandi*. In the case of the principal *pains* there is a celebrated register of the distribution—the *Lal Bahi*—prepared by the former owners of the Tekari Raj, and the entries in this book are still accepted as evidence of the rights of the villages specified in it. Disputes, however, frequently occur. One village often tries to get more water than it should, or else when the rainfall is scarce, villages lower down seek to get water before their proper turn; and the disputes sometimes terminate in blows, and occasionally in bloodshed. Quarrels are also common in regard to *bandhs* or *garandis*, erected across the *pains* or *bhoklas* to steal or divert the water, thus depriving lands further down of all supply; but considering the number of these channels and the vital importance of water in years of unfavourable rainfall, and considering the fact that they are all under the private control of the zamindars and tenants, it is surprising how few cases end seriously. "

Observations made in the above paragraphs by Mr. O'Malley still hold more or less good. Since the system of zamindari has been abolished in the district of Gaya, the ownership of *pains* has vested into the Government.

Pains which are silted up and when they do not function properly beneficiary tenants approach the authorities for getting the *pains* desilted or cleared up and after proper arrangement by Anchal Adhikari they are taken up as emergency schemes under the Public Irrigation Works Act.

Ahars.

Regarding *ahars* or water reservoirs O'Malley observes :

" Side by side with *pain* system is that of *ahars*, the latter being constructed essentially for the irrigation of the high lands between the rivers which the *pains* cannot serve, though some are also constructed on the lower levels where *pains* are practicable. An *ahar* is an artificial catchment basin formed by blocking the drainage of the surface water, or even by blocking a small drainage rivulet, and thus locking up the water. These catchment basins are nearly always of a more or less rectangular shape, embankments being raised on three sides of the rectangle, while the fourth side is left open for the drainage

water to enter. Owing to the slope of the land, the highest embankment is usually on the north, and this embankment generally runs east and west. From either side of it other embankments project southwards, diminishing in height as they proceed, according as the level of the ground rises. In this way a three-sided catchment basin is formed deepest at the northern side, where there is always some arrangement to let out the water for the purpose of irrigation at the spot where the drainage of the catchment would naturally issue if there were no embankments.

" If the *ahar* is built on a drainage rivulet and thus receives the drainage of a larger area than its own, there is a spill or weir to pass off surplus water, which may perhaps flow to another *ahar* further north. In small *ahars* where the quantity of water banked up is not great, it is generally sufficient to cut a narrow passage through the earthen bank at the deepest spot to draw off the water as required. If the mass of water is greater, a half pipe, formed out of the trunk of the palm tree and known as a *donga*, is let into the bank to protect it from excessive erosion; and if the *ahar* is a very big one, a masonry outlet is often built into the bottom of the bank which goes by the name of *bhao* or *bhooari*. The different parts of an *ahar* also have distinctive names. The bed inside the embankments is the *pet* or belly, the banks are called *pind*, the side banks being known as *alang* and the main bank at the lowest side of the *ahar* as the *pith* or back—a name which is also frequently given to the portion behind the main embankment.

" When the water is wanted to irrigate, not the lands to the north, which are on a lower level but the lands to the east or west on the same or higher level, it is lifted by one of the methods for raising water mentioned above. One or other of these lifts is erected on the edge of the *ahars*, and the water is raised into a channel on a higher level through which it flows to the field where it is required. If the water in the *ahar* is low and does not reach the bank, a depression (*kandari*) is dug by the side of the bank, and a small channel is cut from the deep part of the *ahar* leading into this depression. Sometimes when the level of the water is very low, it is necessary to employ a series of two or even three lifts to raise it to the level required.

" The prime value of these catchment reservoirs is that they store up the water that would otherwise be carried away by the naturally rapid drainage of the country. They are in fact indispensable on the higher tracts that lie between the river basins, firstly for irrigating the paddy as it grows up, and secondly for the sowing and germination of all the *rabi* crops. On these high lands *pains* are not practicable; and if it were not for the *ahars*, there would be no water available for the purpose of irrigation after the month of September. Almost half the irrigation in the district is affected by the *ahar* system, which is quite distinct from that of *genrabandi* mentioned below and also from that of *pain* irrigation. A *pain* may eventually lead into an *ahar* after it

has almost spent itself, but as already stated, *pain* irrigation is not possible on the highest lands for which the *ahars* have been specially devised. They are in fact usually constructed on high lands in the parallel strips lying between the rivers where the clay is comparatively hard and little silt accumulates whereas the *pains* take off from the sand laden rivers and irrigate the lands situated in the river basins. These *ahars* are often of great size, the largest irrigating about 1,000 acres. They are usually kept in good repair, by digging a layer of soil from the bed of the *ahars* and heaping the soil on the banks. As in the case of *pains*, small repairs are done by the tenants, and large repairs requiring considerable expenditure are carried out by the landlords. "

These observations still stand good to a great extent.

Genrabandi.

Writing about the system of *genrabandi* Mr. O'Malley states : " The system of *ahars* and *pains* which prevents the water escaping and makes it available for cultivation is further supplemented by that known as *genrabandi*. It has already been remarked that the country slopes gradually to the north and that the rivers and hill streams, issuing from the hills and flowing northwards, intersect it and cut it up into a number of parallel strips. Each of these watersheds again has a strong slope east and west from the centre down to the river-beds, and much of the land is too high for artificial irrigation and depends for its moisture on the rainfall. A series of low retaining banks is therefore built across the line, which is connected by other banks running north and south. The main outer embankment (*gherawa*), which is about 4 feet high, encloses a considerable area; this is split up by minor embankments called *genera* and within these again are low banks (*al*) round the fields. This series of banks, which has aptly been described as resembling an enormous chess-board is admirably adapted for retaining the surface water, as not a drop is allowed to flow beyond their limits and the stiff soil is given time to absorb the moisture. This system is known as *genrabandi* and is followed not only on the high lands, but also in the irrigated area, in order to ensure the fullest possible use being made of all the water available. " This system of irrigation stands as it was.

Wells.

As regards well irrigation Mr. O'Malley observes : "As water does not remain in the rivers for more than a few months and the *pains* usually dry up before the end of the year, irrigation must be carried on from *ahars* or wells when this source of supply fails. In a dry season the *ahars* also dry up by the end of the year, and from January to June recourse must be had to wells, except when rain falls. Well irrigation is almost entirely confined to the immediate vicinity of the villages, where poppy* and garden produce, *marua*, barley and similar crops

*No poppy is grown now. (P. C. R. C.)

are grown, and where the produce is much better and more valuable than in the lands further from the village, which are irrigated from *pains* and *ahars*. Perhaps 90 per cent of the wells in the district is in lands immediately adjoining the village, and they are hardly ever used for the *kharif* or the larger portion of the *rabi* crops. Temporary wells are also commonly used in tracts where the soil is sandy or along water-courses. Such wells afford considerable protection against drought to the poppy which is so largely grown in the district, and also to other dry crops. It has been estimated that 12 or 13 per cent of the total irrigation is effected from wells." Most of the observations of Mr. O'Malley are not out of date. At present (1955) the area irrigated by wells comes to 1,16,521 acres. Total area irrigated by all sources comes to 12,62,014 acres. Though irrigation from wells still continues, an improvement is seen by the use of Persian Wheels and Electric Grid system which assure more water-supply.

The following passages from the old District Gazetteer which still hold good are quoted :—

" *Water-lifts*.—The methods of drawing and distributing water are those common to the whole of Bihar, and here as elsewhere, the most usual contrivance for lifting it is the *lath* or lever. This consists of a long beam working on an upright forked post, which serves as a fulcrum; at one end the beam is weighted with a log, stone or mass of dried mud, and at the other is a rope with a bucket attached, which when not in use rests above the well. When water is required the cultivator pulls down the rope till the bucket is immersed; as soon as the extension is relaxed, the weight attached to the lever raises the bucket of itself; and the water is then emptied and led by narrow channels into the fields. Irrigation by means of the *mot* (leather bucket) is much rarer. When this method is employed, water is raised by a large leather bucket secured to a rope, which passes over a rude wooden pulley supported by a forked post, and is fastened to the yoke of a pair of bullocks. These supply the motive power, for as soon as the bucket has been filled, they descend an inclined plane varying in length with the depth of the well, and thus bring it to the surface. One man is required to look after the bullocks and another is stationed on the well to let down the *mot* and empty it when it comes to the surface.

" Two other water-lifts commonly used are the *karin* and *sair*. The *karin* is a long wooden scoop; made out of a single piece of wood, hollowed out and shaped like one-half of a canoe. The broad open end of this scoop rests on the water channels leading to the field, and the pointed closed end is dipped into the water, which is then raised by means of a lever overhead with a weight at the end of it. This machine is used for lifting water either from the reservoirs (*ahars* which are so numerous in the district) or from a lower to a higher channel where water is plentiful and the elevation small. The *sair* or *chanr* is used when the quantity of water remaining is small; it is a triangular basket made of bamboo with the edges raised on two sides, cords are

attached to each side, and these are held bytwo men one standing on either side of the ditch from which the water has to be raised. Holding the ropes attached to either side, they swing it backwards, and bringing it down sharply into the water, carry the forward motion of the swing through until the basket, now full of water, is raised to the level of the water-channel, when the contents are poured out. "

Canals.

In the old District Gazetteer Mr. O'Malley writing about canals mentions : " The north-western portion of the district is not dependent on the methods of irrigation mentioned above, as it is served by a portion of the Son Canal system. This system derives its supply from an anicut across the Son at Barun, which was begun in 1869, and completed in 1875 at a total cost of 15 lakhs of rupees. The anicut or weir, which is 12,469 feet long, consists of a mass of rubble stone laid to a uniform slope and stiffened by walls of masonry founded on shallow wells. Scouring sluices are provided at either flank; and these are fitted with gates which can be opened or closed at any state of the river other than high flood. By means of these gates the level of the water in the pool above the weir can be kept at the height required to feed the canals. Here the Main Eastern Canal branches off and runs as far as the Poonpoon river, 8 miles to the east. It was originally intended to carry this canal as far as the Monghyr district, but after being cut as far as the Poonpoon, the project was abandoned. The Patna Canal leaves the Main Eastern Canal 4 miles from the Son, and running north through the *pargana* of Arwal almost parallel to the western boundary of Gaya, eventually joins the Ganges at Digha between Bankipur and Dinapur. Its total length is 79 miles of which 43 miles lie within this district, where it irrigates parts of the *parganas* of Siris, Dadar and Goh, and the greater part of Arwal. The total area commanded by these two canals and their distributaries is 1,70,000 acres, being bounded on the north by the Patna district, on the south by the Grand Trunk Road, on the east by the river Poonpoon and on the west by the Son. It is estimated that 1,66,000 acres are annually irrigable, but the area actually irrigated has never been anything like this figure. In 1904-05 it was 56,400 acres, of which 48,700 acres were under rice. Though the area actually under irrigation is even now only one-third of that irrigable, it has been expanding speedily, and it is now 50 per cent greater than in 1893-94 ". The total area irrigated by the Son Canal system at present (1955) comes to 1,29,852 acres.

Mr. O'Malley further mentions about the canal administration as follows :—

" The whole system is under the control of a Superintending Engineer, who is assisted by an Executive Engineer and an Assistant Engineer. The latter are responsible for the maintenance of the canals and the conduct of irrigation operations and a separate establishment is

entertained for the collection of the revenue. The irrigated area is divided into blocks, the lease of all the lands in each block being arranged so as to lapse in the same year; and in fixing the period of the leases efforts are made to see that leases for an equal area expire each year. Water is supplied to the cultivators on application on a prescribed form, the year being divided into three seasons, that is, hot weather, *kharif* and *rabi*. A date is fixed for each season, and the lease or permit granted for that season is only in force for that particular period.

" Besides the season leases, there are long-term leases, or leases for a period of seven years, which are granted at a somewhat reduced rate. These long-term leases are only granted for compact blocks defined by well-marked boundaries of such a nature that the leased lands can be clearly distinguished from the adjoining unleased lands, and also so situated that unleased lands will not be ordinarily irrigated by water supplied for the land included in the block. These boundaries are mentioned on the application for the lease on receipt of which a special report is submitted to the Subdivisional Canal Officer. If the lease is likely to be approved he issues orders for the block to be measured, and a detailed *khasra*, or measurement of each cultivator's holding is then made. The lease is finally approved by the Divisional Canal Officer who issues the permit, but before this can be done, every cultivator who has fields within the block, must sign his name against the area which has been measured, and which will be assessed in his name. In order to admit of a lease getting water for the season, provisional permit is granted for the season on the area originally applied for; this permit is cancelled when the long-lease permit is finally granted. Fields which cannot be ordinarily irrigated, or for which canal water is not ordinarily required can be excluded from the block such fields being duly noted in the *khasra* or measurement paper.

" In these long-term leases water-rates are charged for the area measured and accepted by the cultivators, whether water is required or not; and the channel by which the area is irrigated as well as the name of its owner must be registered. In *rabi* and hot-weather leases water is supplied on application, and water-rates are levied on the actual areas irrigated, and not necessarily on those specified in the application. In order to assist the Canal Department as far as possible in regulating and distributing the water to the different cultivators named in the leases, *lambardars* or headmen are appointed; these are influential men of the village, who are appointed on the approval of the majority of the cultivators concerned. Their duty is to assist in measurements, to give in the names of the cultivators of the different holdings, and to see that water is properly distributed over the leased area. For these duties they are paid a commission of 3 per cent on the total assessment of long leases and of 2 per cent on season leases. "

The canal administration now is a direct responsibility of the irrigation staff and under the supervision of a Deputy Collector with his headquarters at Arrah.

Working of the Indigenous System of Irrigation.

The following passages occur in the old District Gazetteer in respect of the working of the indigenous system of irrigation :—

" Canal irrigation has turned a most unfertile tract, a large part of which was sandy and unproductive, into a region of rich fertility. It serves, however, but a comparatively small portion of the district, and the remainder is dependent on the indigenous methods of irrigation mentioned above. There can be no doubt that the latter system is absolutely indispensable, and that without it a large portion of Gaya would be converted into barren waste. The construction and maintenance of these irrigation works is consequently a matter of supreme importance, but unfortunately there is a tendency of let them fall into disrepair. Owing to the general prevalence of produce rents and the physical and climatic condition that necessitate the upkeep of artificial works of irrigation, the duty of inaugurating and maintaining them lies to a peculiar extent upon the landlords. The *ryots* could not or would not combine of their own accord to keep them up. Individually, they have not the capital necessary to undertake expensive works of such magnitude, and collectively they have not yet acquired sufficient self-reliance to unite among themselves for the purpose of constructing them. The result is the customary obligation of the landlords to construct and maintain these works of public utility; but the latter are always alive to the necessity and advantage of doing so. This is particularly the case with *pains* which are apt to be neglected while there is a more serious danger in the fact that no new *pains* of any considerable size are being constructed. The largest of these irrigation channels, and those that serve the greatest number of villages, were made many years ago, and when larger areas were under the control of single zamindars, and the local authority of these zamindars to enforce their orders and wishes was more absolute than it has been, or can be, under the restrictions imposed by the legislation of more recent times. As a general rule, no large *pain* is now excavated, and many of the largest of former times have fallen into disrepair and even disuse. This result is due to the gradual disintegration of property, the parcelment of proprietary rights which has been encouraged by modern legislation. Where formerly there was a single Zamindar in more or less absolute authority, there are now perhaps fifty petty land-holders, whose interests conflict or whose relations are so strained that they can never combine to carry out a work of mutual benefit. As an instance of this, it will be sufficient to cite the case of a *pain* now in almost complete disuse, which is reported to have served a hundred villages in its day. This *pain* passed through a tract of country, where, owing to three successive years of scanty rainfall, scarcity was apprehended, and the Collector endeavoured to persuade all the land-holders through whose properties the channel passed, to combine and repair it, as a certain remedy against scarcity in the future. These efforts were unsuccessful; many of the Zamindars were quarrelling and

engaged in litigation *inter se*; and nothing would induce them to carry out the work.

" Not only are *pains* liable to be neglected owing to the subdivision of proprietary rights, but their number is apt to diminish owing to the want of a proper headwork to control the inflow, as well as to regulate the water-level of the channel at its entrance. Much damage is caused by *pains* scouring out the head and sometimes such widening and deepening results in the channel of the *pain* becoming ultimately the course of the river. In this way, the original bed of the river becomes silted up; the tract of country formerly irrigated from it by other *pains* taking off lower down are left without means of irrigation, and cultivated lands are converted into waste; while the main stream, having adopted the artificial channel of the *pain*, cut away the adjoining land and floods and depreciates other lands by a deposit of sand. "

A good deal of changes have taken place since then. In view of the slackness on the part of landlords the Bihar Private Irrigation Works Act of 1922 was promulgated with a view to putting pressure on the landlords for proper care and maintenance of irrigation facilities to the respective tenants. Moreover, the Collectors were now empowered to take notice of petitions filed by the tenants and were authorised to select agency for execution of irrigation schemes and get the work completed. The landlords concerned were called upon to pay the amount incurred towards completion of irrigation schemes. This procedure operated till March, 1948. Since 1948-49 Government have been paying increasing attention to expansion and development of Minor Irrigation Schemes and have been allotting considerable amount for minor irrigation works in all important sectors of this district.

The principle now in vogue is that 50 per cent is to be raised on contributory basis from the beneficiary landlords and 50 per cent of the cost is being met by Government. The result is that substantial progress has been achieved and adequate momentum has been gained in pushing up various schemes of minor irrigation. A number of schemes have been taken up and completed and all these have tended to improve the fertility of the soil and has contributed to larger production of crops.

The following figures will indicate the number of schemes taken up, completed and the amount spent towards these from 1948-49 to 1954-55.

Statement of Minor Irrigation Works.

Year.	Subdivision.	Number of schemes taken up.	Number of schemes completed.	Amount spent.
1	2	3	4	5
				Rs. a. p.
1948-49 ..	Sadar	146	101	2,51,656 0 0
	Aurangabad ..	102	92	1,40,243 0 0
	Jahanabad ..	46	46	1,03,200 0 0
	Nawada	105	98	1,87,000 0 0
		399	337	6,82,099 0 0

Year.	Subdivision.	Number of schemes taken up.	Number of schemes completed.	Amount spent.
1	2	3	4	5
				Rs. a. p.
1949-50	.. Sadar	449	254	5,25,995 0 0
	Aurangabad ..	221	158	2,33,061 0 0
	Jahanabad ..	87	69	1,35,389 3 6
	Nawada	190	184	2,82,193 0 0
		947	665	11,76,618 3 6
1950-51	.. Sadar	922	535	7,87,000 0 0
	Aurangabad ..	270	188	2,60,000 0 0
	Jahanabad ..	212	134	1,33,000 0 0
	Nawada	225	187	2,70,000 0 0
		1,629	1,042	14,50,000 0 0
1951-52	.. Sadar	444	329	10,16,212 0 0
	Aurangabad ..	148	124	2,73,839 0 0
	Jahanabad ..	102	94	2,80,000 0 0
	Nawada	112	102	3,34,441 0 0
		806	649	19,04,492 0 0
1952-53	.. Sadar	80	67	1,13,545 0 0
	Aurangabad ..	23	15	25,681 0 0
	Jahanabad ..	21	21	1,07,442 9 0
	Nawada	20	8	24,018 0 0
		144	111	2,70,686 9 0
1953-54	.. Sadar	151	60	1,22,784 0 0
	Aurangabad ..	86	46	1,25,000 0 0
	Jahanabad ..	55	38	90,000 0 0
	Nawada	41	40	1,02,788 7 6
		333	184	4,02,573 7 6
1954-55	.. Sadar	..	97	2,65,578 0 0
	Jahanabad ..	..	20	36,023 0 0
	Aurangabad ..	..	15	22,800 0 0
	Nawada	..	8	20,336 0 0
		..	140	3,44,737 0 0

LIVESTOCK.

Cattle.

In the district of Gaya local breed of cattle are generally found but for draught purposes mostly *bachaur* breed are preferred. Very few *hariana* are also found for cart purposes and very few cows of Shahabad and Sahiwal breed of cattle are found for milk purposes. The local breed are mostly of poor quality.

In the old District Gazetteer Mr. O'Malley mentioned : " The cattle are specially small in the south, and in consequence of their poor physique, three bullocks, viz., a pair under a shaft and a leader attached in front of the shaft, are constantly used to draw a loaded cart. " Similar condition is still continuing. The cattle falling north of the Grand Chord Railway are on the whole in better condition than those of the south. The best type of cattle both in respect of condition and breed is localised in the canal zone from Obra to Arwal. The cause may be attributed to scarcity of fodder, which in the south due to insufficiency of moisture, is more acute than in the north. The breed also is such that a better and strong cattle cannot be expected. Tendency of people towards the upkeep of animal is by far no less responsible for this as only 5 per cent are interested in the animal upkeep.

Cattle generally are utilised for plough and cart purposes. In hilly and some other tracts male buffaloes are also employed for plough as well as for cart purposes.

Recently some bulls, especially *hariana* and *tharparkar* bulls, have been issued to cattle breeders to improve the cattle breed. The distribution of bulls started from 1948 and an appreciable number of progeny have been produced, which have been tatooed for identification purposes. This has been supplemented by the establishment of two artificial insemination centres, viz., at Gaya and Jahanabad. Fodder seeds have been distributed in the district free of cost or on nominal price to the interested cattle-keepers in order to solve the fodder problem. *Napier*, burseem, and teosentle fodder seeds are getting favour in the hands of cattle-owners, although extensive propagation is impeded by the lack of irrigational facilities.

Buffaloes.

The chief value of buffaloes lies in the fact that they yield more milk than cow. But these are also mostly non-descript type and have on the whole very limited capacity of milk production. At times buffaloes are also used in plough and cart.

Very recently a redeeming feature was noticed in buffalo breed. *Murra* breed has emerged out due to breeding with the strong *murra* buffalo bulls, straying away mostly from Shahabad district. A few have also been imported from the Punjab. The effects of improvement are specially visible in Arwal and Daudnagar areas.

Common Cattle Diseases.

The diseases with which animals generally suffer in the district are : (*i*) rinderpest, (*ii*) hæmorrhagic septicæmia, (*iii*) anthrax, (*iv*) black quarter, (*v*) foot and mouth diseases, and (*vi*) bovine surra.

There had been 62 outbreaks of hæmorrhagic septicæmia with 275 seizures and 178 deaths, 38 outbreaks of anthrax with 172 seizures and

129 deaths, 7 outbreaks of black quarter with 24 seizures and 17 deaths, 27 outbreaks of foot and mouth diseases with 503 seizures and no death and 20 outbreaks of bovine surra with 7 seizures and 6 deaths in the district of Gaya in the year 1951-52.

Veterinary Hospitals and Dispensaries.

There are four veterinary hospitals in the district, namely, at Gaya, Aurangabad, Nawada and Jahanabad, where livestock are cured of diseases as indoor and outdoor patients. There are also thirteen veterinary dispensaries in the district at Sadar Gaya, Tekari, Wazirganj, Sherghati, Imamganj, Rafiganj, Daudnagar, Nabinagar, Nawada, Warsaliganj, Rajauli, Jahanabad and Arwal. One more dispensary is about to be started by the Government at Fatehpur shortly. Each veterinary dispensary has two Field Veterinary Dispensaries under it. These are attended by the touring Veterinary Assistant Surgeons on every week-day.

In the four veterinary hospitals 423 in-patients, and 7,507 out-patients received treatment and 1,811 scrub bull calves were castrated by Burdizzo's methods in the year 1951-52.

In the dispensaries 24,189 patients of bovine, equine and other species of animals received treatment for non-contagious diseases whereas 442 cattle received treatment for contagious diseases, 8,693 scrub bull calves were also castrated in the year 1951-52.

The following passage is quoted from the old District Gazetteer of 1906 to give the reader a comparative view of the subject in question :—

> " The diseases most prevalent among cattle are rinderpest and foot and mouth diseases; over 1,000 cases of rinderpest and 550 cases of foot and mouth diseases were reported in 1903-04. Veterinary assistance is afforded by itinerant Veterinary Assistants and as also by veterinary dispensary which the District Board maintains at Gaya; 70 horses and 81 cattle were treated as in-patients at this dispensary in 1904-05 and 352 horses and 644 cattle as out-patients. "

The following cattle fairs and shows are held every year in the district :—

(*i*) Bhusunda, Sherghatty, Mahkar (Amraut), Barachatty and Dharhar under Sadar subdivision.

(*ii*) Kako and Manikpur under Jehanabad subdivision.

(*iii*) Deskund, Kara and Beriawan under Aurangabad subdivision.

The fairs and shows are attended by the touring Veterinary Assistant Surgeon of the respective locality.

A *Goshala* Improvement Scheme has also been launched in the district. Under this scheme 4 pedigreed *tharparkar* bulls have been supplied to *goshalas*. Warsaliganj, Jahanabad, Raniganj and Deokund *goshalas* have been supplied with one bull each. Besides assistance has also been offered to these *goshalas* for providing grazing land and for fodder cultivation, irrigation facilities, etc. Transport facilities for cattle and cattle foods and veterinary aids have also been given to these *goshalas*.

Abovementioned facts disprove, though not totally, the remark of Mr. O'Malley, namely, " the stock has little chance of improvement as besides the want of careful and systematic breeding, there is difficulty in obtaining pasturage. "

Hides and bones from the district are exported to Calcutta and Madras as there is no tannery in the district.