The New Village-II
Technological Change in Agriculture
V Nath

This study of a village in Central Punjab aims at identifying the growth factors in agriculture.

The first part of the study, which appeared last week, presented the basic data on demographic characteristics, land-holdings and economic activity. In this, the second part, the different facets of the technological change in agriculture in the village are examined.

The picture that emerges is that of an agricultural community in which there have been notable advances in methods of utilisation of resources and a process of rapid adoption of improved agricultural practices is well under way.

This process began with consolidation of holdings which was followed by a rapid increase in the number of irrigation wells and electrification of most of these wells. These three developments made possible a more intensive cropping pattern, more adequate irrigation and care of all the crops grown, and increasing attention to adoption of recommended improvements, notably use of chemical fertilisers.

A stage has now been reached when adoption of improved practices has become part of the agricultural enterprise of the average farmer. Further, beginnings of highly specialised types of commercial farming or livestock enterprises, like commercial poultry production, have already been made.

The area is now ready for larger changes, which would bring about major transformations in farming techniques and making farming significantly more specialised and commercial.

PATTERN OF LAND HOLDINGS

It has been noted in Table 2 (p 682, The Economic Weekly, April 17, 1965) that the 82 cultivating families of the village cultivate a total of 1103 acres. This gives a crude average of 13.45 acres per cultivating family. The villagers consider those cultivating between 5 and 20 acres are very small in number and between 10 and 11 acres, and that the median cultivated holding is 10.5 acres. Families cultivating above 20 acres are also very few. Several of them are undivided joint families.

On further classification by one acre divisions, it is found that the largest number of families (70 out of 82) cultivate between 5 and 20 acres. Families cultivating less than 5 acres are very small in number and have only a part-time interest in cultivation. Families cultivating above 20 acres are also very few. Several of them are undivided joint families.

On further classification by one acre divisions, it is found that the largest number of families (21) cultivated between 10 and 11 acres, and that the median cultivated holding is 10.5 acres. The villagers consider those cultivating between 8 and 14 acres as medium-sized cultivators. Such cultivators number 38, somewhat less than half of the total. Data on farm operations of the ten sample cultivators of this group are presented in Table 4.

It will be seen that the net disposable income of these cultivating families ranged from about Rs 1,200 to over Rs 5,500 per year; the variation being dependent upon the number of workers in the family, the area cultivated, whether irrigation was being done by bullocks or by electric motor and the level of fertilizer use. This income remained with the family after meeting all its needs of food, providing for fodder for livestock including milch animals, and paying all the cultivation expenses (e.g. for seed, manures and fertilizers, labour etc). The value of the foodgrains and other produce (gur, khandari sugar and cotton) retained by the families for domestic use varied from Rs 1,275 to Rs 2,360. Each family was keeping besides bullocks, two or more milk-yielding bullocks and since the milk yields are fairly high (8 kg per baffle per day or higher) the milk was sufficient for meeting all the milk and ghee requirements of the family. Further, all families grew some vegetables and had kept a few poultry birds also. Accordingly, the food needs of the families were met almost fully, and at a fairly satisfactory level of nutrition; and the disposable income was available for expenditure on clothing, repair or extension of the house, education, travel and miscellaneous expenses.

The calculation is not very refined, but it is adequate for the purpose of obtaining an approximate idea of the economic level of the middle cultivator. It is clear from it that this cultivator is considerably above the subsistence level: that he has a small surplus for education, travel and other needs after meeting his elementary needs for food, clothing, housing etc. Data on the character of housing, facility of electricity and water supply in the house, and possession of durable goods given later and general observations in the village also point to a similar conclusion. The main significance of this conclusion is that since the cultivator is not constantly pre-occupied with meeting his barest minimum needs, he can afford to bring a business approach to his cultivation, to take some risks and to make experiments with new practices. The extension staff emphasised that this latter had been one major result of the economic changes of the last fifteen years. As the VLW put it, "Earlier the sole aim of the cultivator was to feed his family and that of the Harijan who worked for him. Now however, several of them aim at making more money and are looking for changes in practices which would enable them to do so".

LAND USE AND THE CROPPING PATTERN

Data on distribution of the cropped area among principal crops in 1951-52, 1956-57 and 1961-62, as obtained from the records of the Revenue Department, are given in Table 5.

These figures do not show any noteworthy change either in the net area sown or in the gross cropped area during this period. But there is an increase of about 200 acres in the irrigated area. In 3961-62, 85.6 per cent of the cropped area of the village was irrigated. In 1961-62, 85.6 per cent of the cropped area was irrigated. In 3961-62, 85.6 per cent of the cropped area was irrigated.

Table 3: Distribution of Families by Sizes of Cultivated Holdings

<table>
<thead>
<tr>
<th>Size of Cultivated Holdings</th>
<th>Number of Families</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 5 acres</td>
<td>3</td>
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<tr>
<td>5 to 10 acres</td>
<td>22</td>
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<tr>
<td>10 to 15 acres</td>
<td>30</td>
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<tr>
<td>15 to 20 acres</td>
<td>18</td>
</tr>
<tr>
<td>20 to 30 acres</td>
<td>4</td>
</tr>
<tr>
<td>30 acres and above</td>
<td>5</td>
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</table>
received irrigation. Irrigation was almost entirely from wells. Out of 951 acres irrigated in 1961-62, 940 acres were irrigated by wells. The increase in irrigation during this period has been due to an increase in the number of wells (from 30 to 51) and electrification of a large number (36) of these. The area under canal irrigation is very small, only 11 acres. The distributary of a canal passes through the village; but very few cultivators take water from it. The main reason given for not taking water from the canal is that there is sufficient water in the wells, and cost of lifting it is not too high. The fear of water-logging, which is a major problem in some of the canal-irrigated areas of Central Punjab, also discourages use of canal water.

The figures of Table 5 show significant changes in the cropping pattern, with increases in areas under more remunerative and higher-yielding crops like cotton, maize and the winter fodder berseem, and decreases in those under lower-yielding crops like gram, rabi grain mixtures (wheat-gram, gram-barley) and the summer fodder chari. The area under maize has doubled during this period; cotton which was not grown in 1951-52, has become an important crop and acreage under berseem has also increased. All these crops yield much more than the crops they have replaced. Maize and cotton are higher yielding or are more remunerative than gram or wheat-gram or barley-gram mixtures. Berseem similarly yields much more than chari. It gives 5, 6 or more cuttings in one season, compared to one cutting of chari. The value of fodder from an acre under berseem is estimated at about three times that from an acre under chari.

This change in the cropping pattern has become possible because of increased availability of irrigation, and especially because the cultivator has a much larger quantity of water entirely under his control. He can follow an intensive cropping pattern and ensure adequate attention to each of the crops grown by him. During discussions in the village, the cultivators repeatedly referred to the latter fact.

CONSOLIDATION AND ELECTRIFICATION

All cultivators were agreed that the present phase of rapid improvement in agriculture, started after consolidation of holdings which was completed in the village during 1951-52. The advantages of consolidation of holdings for more efficient and intensive cultivation are so well known that it is not necessary to explain these here. However, the case of the Sarpanch may be mentioned to illustrate the point. He said, "Before consolidation my family had share in lands falling under 13 wells; but after consolidation all our lands came under one well, though we constructed another well later." Consolidation of holdings was followed by a spurt of development activity, the most important feature of which was extension of well irrigation. The village had 30 wells in 1951-52. By 1961-62 the number had increased to 45. In addition, there were 6 kutcha-bore tubewells in the latter year, bringing the total number of irrigation units to 51. The village received electricity in 1954; it was among the first villages in the block to receive it. Electrification was followed by a wave of installation of electric motors on the wells. Eleven motors were installed within one month in 1955 when a large tackavi loan was sanctioned for this purpose by the State Government. At the time of this study, 29 out of 45 wells had electric motors and one had a diesel engine. In addition, the 6 kutcha-bore tubewells mentioned above were also fitted with electric motors. This kutcha-bore is an interesting innovation because it enables a cultivator to

<table>
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<tr>
<th>Table 4: Farm Operations of Ten Sample Medium Cultivators</th>
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<tr>
<td>Sl No</td>
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<tr>
<td>(1)</td>
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<td>(8)</td>
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<tr>
<td>(9)</td>
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<tr>
<td>(10)</td>
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</tbody>
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* Has other dependents also.
+ Plus Rs 600, income from carting.
** In addition one sanjhee kept and paid 1/9 share of production.
start irrigating his land without constructing a pucca well. A tube is inserted in the ground by digging a kutcha hole, a pumping set and electric motor are installed on it and irrigation is started immediately but the pucca well is constructed after two, three or more years when the cultivator can spare the capital. It was also reported that some farmers in neighbouring villages had two or three such bores in different parts of their farms and used portable motors which they took from one hole to the other. This latest innovation which saves time and investment is an indication of the facility which the cultivators have acquired in the technique of irrigation with the help of electric motors.

Installation of electric motors was helped by liberal grants of taccavi loans by the State Government. Loans for 8 electric motors totalling Rs 13,000 were sanctioned during 1955, when the first set of motors was installed and till the time of this study, loans totalling Rs 26,300 had been sanctioned for 15 electric motors. Thus, taccavi loans have financed electrification of half the wells in the Tillage.

Electrification makes possible lifting of water at a markedly lower cost, besides allowing a saving of time in irrigation. The estimate given in Table 6 of the comparative cost of irrigation of one acre of wheat by electric pumping and by lifting water with the help of bullocks was given by one cultivator and is generally accepted. Irrigation with an electric pumping set besides being much cheaper is also much more intensive and adequate. It was explained that with an electric pumping set four waterings for the wheat crop were adequate; but with bullocks 6 to 7 waterings were required.

The effect of electrification of wells has not been so much increase in area under irrigation, as more adequate and intensive watering of the irrigated land. The saving of labour of man and beast, which electrification has brought about, has been utilised by cultivators mainly in this form of more adequate and intensive irrigation of their crops, which along with increased use of fertilizers and other improved practices, has resulted in increased yields. Improvement in the quality of livestock has been another striking benefit. This has resulted both from reduced strain on bullocks—lifting water for irrigation is considered extremely strenuous for the bullocks—and better feeding, which has become possible as a result of larger area under green fodders. Explaining this point, one cultivator said, “Now we have green fodder the year round, with the result that we feed our animals better and also make a saving on the grains which we used to feed them earlier”.

### MORE INTENSIVE MANURING

This is probably the second most important aspect of technological change in agriculture. It consists both in better use of farm-yard manure and greatly increased use of chemical fertilizers. The latter which began only during the early 50s, has shown a rapid increase especially during the last five years as the figures in Table 7 bring out.

This village is not exceptional in the progress of fertilizer use or in the average quantity of fertilizer used per acre. The total fertilizer consumption in the block itself has increased from 295 tons in 1956-57 to 2,141 tons in 1961-62 and is expected to reach 4,000 tons in 1963-64. The average figure per cultivated acre in the village was 344.0 kg per acre as compared with 25.3 kg for the block. The highest average of almost 100 kg per cultivated acre was reported from the garden colony village mentioned later.

Use of chemical fertilizers has become an integral part of the agricultural pattern of the village. The VLW mentioned that practically every cultivator in the village was using chemical fertilizers, and that a large number were following the dosages recommended by him. One reason for the popularity of chemical fertilizers is that the average cultivator realises that the increasingly intensive cropping pattern which he is now adopting, cannot be sustained without their use. He understands that he just does not have adequate farm-yard manure for all his crops and most use chemical fertilizers in addition. There is good awareness also of the relative cost and returns from fertilizer use. In one of the discussions, a cultivator mentioned that in case of the wheat crop, the cost of the chemical fertilizer was recovered from the additional chaff which they got as a result of the higher yield, and the additional grain was their profit. There was general agreement with this view. Another indication of the cultivators’ understanding of chemical fertilizers may be had from the speed with which the new fertilizer CAN (calcium ammonium nitrate) has spread. In tie early years of the CD block, the extension staff popularised the use of ammonium sulphate but during the last three years, when there has been a shortage of ammonium sulphate, and CAN from the Nangal Fertilizer Factory has been

### Table 5: Distribution of the Cropped Area Among Principal Crops

<table>
<thead>
<tr>
<th>(Acres)</th>
<th>1951-52</th>
<th>1956-57</th>
<th>1961-62</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total geographical area</td>
<td>1,238</td>
<td>1,239</td>
<td>1,239</td>
</tr>
<tr>
<td>Net area sown:</td>
<td>1,132</td>
<td>1,118</td>
<td>1,118</td>
</tr>
<tr>
<td>Irrigated</td>
<td>786</td>
<td>771</td>
<td>951</td>
</tr>
<tr>
<td>Unirrigated</td>
<td>346</td>
<td>347</td>
<td>167</td>
</tr>
<tr>
<td>Gross cropped area:</td>
<td>1,637</td>
<td>1,663</td>
<td>1,639</td>
</tr>
<tr>
<td>Irrigated</td>
<td>1,256</td>
<td>1,271</td>
<td>1,440</td>
</tr>
<tr>
<td>Unirrigated</td>
<td>381</td>
<td>372</td>
<td>199</td>
</tr>
<tr>
<td>Area sown more than once</td>
<td>505</td>
<td>545</td>
<td>521</td>
</tr>
<tr>
<td>Percentage of net area sown</td>
<td>44.6</td>
<td>48.7</td>
<td>46.6</td>
</tr>
<tr>
<td>Area under crops</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kharif: Maize</td>
<td>121</td>
<td>188</td>
<td>240</td>
</tr>
<tr>
<td>Cotton</td>
<td>—</td>
<td>198</td>
<td>143</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>191</td>
<td>99</td>
<td>178</td>
</tr>
<tr>
<td>Summer fodders:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chari</td>
<td>295</td>
<td>231</td>
<td>195</td>
</tr>
<tr>
<td>Other</td>
<td>249</td>
<td>155</td>
<td>127</td>
</tr>
<tr>
<td></td>
<td>46</td>
<td>76</td>
<td>68</td>
</tr>
<tr>
<td>Wheat</td>
<td>474</td>
<td>357</td>
<td>436</td>
</tr>
<tr>
<td>Other Rabi grains and mixtures</td>
<td>319</td>
<td>276</td>
<td>237</td>
</tr>
<tr>
<td>Winter fodders (mainly berseem)</td>
<td>92</td>
<td>154</td>
<td>164</td>
</tr>
<tr>
<td>Vegetables</td>
<td>4</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Other crops</td>
<td>16</td>
<td>6</td>
<td>11</td>
</tr>
</tbody>
</table>
freely available, they have been propa­
gating use of the latter.

The B D O explained that while
ammonium sulphate was still demand­
ed by cultivators for certain crops —
 it was considered particularly good
for groundnut — the majority of the
cultivators had already switched over
to the use of CAN. They had under­
stood that their crops needed nitrogen,
and that CAN supplied it just as effi­
ciently as did ammonium sulphate
They might not know the English
word ‘nitrogen’; but they had grasped
the basic idea that ammonium sul­
phate, CAN and other manures (like
farm-yard manure) supplied the same
essential element to the soil.

Use of superphosphate for the
wheat and groundnut crops is also in­
creasing rapidly. The latest introduc­
tion is potash. Its use is being propa­
gated by the extension staff for the
wheat crop from this year (1963-64.)
only, and 8 tons of potash have been
distributed in the block area. As the
results are considered to be promising,
the block staff feel that the quantity
could be increased to about 100 tons
next year. The main advantage of
potash is that gives a polished ap­
pearance to the grain, which fetches
a higher price in the market. The
yield is also reported to be somewhat
higher with its use.

Better Use of Farm-Yard Manure

This is linked with consolidation of
holdings on the one hand, and use of
chemical fertilizers on the other. Con­
solidation gave a fillip to use of farm­
yard manure, because as a result of it
all cultivators and most, non-cultiva­
tors who had livestock were allotted
sites for compost pits on the outskirts
of the village. This allotment: removed
the difficulty of land for pits which
many cultivators and non-cultivators
like Harijans who kept cattle, faced.
All these pits are well utilised. In
addition many cultivators have pits in
their holdings also. Experience with
use of chemical fertilisers has aided
use of farm-yard manure because it
has made the cultivators conscious of
the value of their own farm-yard
manure. So long as the cultivators did
not buy fertilizers they were not
acutely conscious of the monetary
value of the farm-yard manure which
they produced themselves or which they
obtained from Harijans and others in the village. But, when they
began to buy fertilizers they began to
be aware of the value of farm-yard
manure also, because they began to
compare what a cartload of farm-yard
manure could do for their crops in
comparison with what a bag of chemi­
cal fertilisers did. Moreover, as a lar­
ger number of Harijans and other non­
cultivators began to have manure from
their newly allotted pits buying and
selling of manure (for cash or in ex­
change for fodder) became more com­
mon. In 1963, the price of one cart­
load of manure during the kharif sow­
ing season (May-June) when most of
the farmyard manure is applied to the
fields, was more than Rs 6 per cart,
and many cultivators were comment­
ting that this was an all-time high.

However, even though there is
greater awareness of the value of
farm-yard manure, and its use has in­
creased, the practice of burning cow­
dung has not stopped. The Compost
Inspector of the block explained that
the cultivators realised that the prac­
tice caused a serious loss to agricul­
ture and that the more progressive
and prosperous ones would be quite
willing to stop it if an alternate fuel
was available easily and cheaply, and
the problem of heating milk for mak­
ing ghee could be solved. As regards
the latter, he explained that cow dung
cakes were essential for heating milk
for ghee making, because of the slow
heat and the particular flavour which
they imparted to the ghee and which
was especially fancied by the village
people. This preference may result in
some cow-dung continuing to be burnt
for heating milk, even after the house­
holds switch over to other fuels. But
the main problem is obviously that of
providing an alternate fuel.

### Table 6: Comparative Cost of Irrigation with an Electric Pumping Set and Bullocks

<table>
<thead>
<tr>
<th>Ruoni irrigation (first irrigation after preparing the land) of one acre of wheat</th>
<th>With Electric Pumping Set (Rs)</th>
<th>With Bullocks (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption of electricity for 6 hours (approx)</td>
<td>2.00</td>
<td>Wages of 2 men for 2½ days @ Rs 2.50 per man per day</td>
</tr>
<tr>
<td>Wages of 1 man for three-quarters of a day @ Rs 2.50 per day</td>
<td>1.87</td>
<td>Expenses of two bullocks for 2½ days @ Rs 5 per day</td>
</tr>
<tr>
<td>Or say, 4.90</td>
<td>Total</td>
<td>3.87</td>
</tr>
</tbody>
</table>

### Table 7: Use of Chemical Fertilisers

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Nitrogenous: Amonium Sulphate CAN</td>
<td>20.00</td>
<td>23.00</td>
<td>24.00</td>
<td>31.00</td>
<td>36.05</td>
</tr>
<tr>
<td>Calcium ammonium nitrate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphate : Superphosphate</td>
<td>3.00</td>
<td>3.05</td>
<td>2.00</td>
<td>7.04</td>
<td>10.01</td>
</tr>
<tr>
<td>Total</td>
<td>23.00</td>
<td>26.05</td>
<td>26.00</td>
<td>38.04</td>
<td>46.06</td>
</tr>
</tbody>
</table>

* Sale of fertilizer between April and November 1963 was about 75 tons and it was estimated by the VLW and the BDO that the total for 1963-64 would be between 90 to 100 tons because top dressing of rabi crops had yet to be done.
As many as ten families have kerosene stoves, which they use for a part of their cooking.

The chief requisite for reducing consumption of cow-dung as a fuel is making available alternate fuels at a cheap price. The families which are already buying fuel will buy any fuel which is cheap and easily available. They will gladly use soft coke or firewood or even electricity if it is cheap. The cultivators and Harijans will have greater resistance to buying fuel. But even they will buy fuel, if it is cheap and conveniently available. The value of cow-dung for agriculture is realised by the cultivators and it is not considered free. But it is used, because it is there and is cheap. The gobar gas plant and more efficient chulhas, especially those which can use agricultural wastes like cotton stocks also have good possibilities of being adopted.

USE OF IMPROVED IMPLEMENTS

The third notable aspect of technological change is use of improved implements. Use of improved iron ploughs, chaff cutters and iron sugarcane presses which began to be used in the Punjab villages 30-40 years has become universal, and newer improvements like furrow-turning and soil-stirring ploughs, bullock carts with pneumatic tyres, chaff cutters and sugarcane crushers driven by electric motors have also been introduced in considerable numbers. The number of implements, including improved implements, at the time of the study is given in Table 8.

It will be seen from the above that the stage of acceptance of small improvements, e.g., iron ploughs or chaff cutters is long past. Even the bullock cart with pneumatic tyres which involves considerable investment, is in general use. The cultivator is now at a stage when he is prepared to adopt any improved implement which is distinctly superior to the one he is using already and which he can afford to buy or hire. Secondly, he is prepared to accept any innovation or modification in existing practice, which results in a clear saving of time, labour or money. This last is very well illustrated by the recent change in the practices regarding threshing of wheat and shelling of maize.

Wheat has been threshed in Indian villages from time immemorial by bullocks going over piles of harvested wheat placed on the ground. This process involves back-breaking labour by men and bullocks for two or three weeks in April and May. Winnowing is done by throwing the wheat and chaff against the breeze. Both these processes have been replaced in the West by the combined harvesters. These machines are beyond the reach of the Indian cultivator; but during the last few years a number of small mechanical threshers costing between Rs. 2,000 and 3,000 have appeared in the markets of the Punjab. Some of these have begun to be used by cultivators in this area also and it was reported that some cultivators of this village had got their wheat threshed by one such machine the previous year. However, more significant than use of this machine is the new practice of using the chaff cutter (which most cultivators possess) for threshing wheat.

In this new process, whole stocks of wheat are fed through the chaff cutter which cuts the chaff into smaller pieces and separates the ears of grain. The mixture is then gone over lightly by bullocks for a few hours and the grain is separated. Another method is to put the ears of grain through the maize-sheller described below. It was reported that nearly 40 per cent of the wheat crop of the village had been threshed in this way during the previous year.

The advantages of the new process are obvious. It results in considerable saving of time and labour during April and May which are among the busiest months of the year. This is the time when cotton and early summer fodder have to be sown and weeding of sugarcane has to be attended to. The cultivator does not have to do back-breaking labour in the hot sun as he had to do in the past, and can devote himself to more fruitful work. The practice has two other advantages also. It reduces risk of loss of grain and chaff from dust-storms and thunderstorms which are quite common at this time of the year and yields better, cleaner grain and chaff because these do not get mixed with the dust. Secondly it does not involve use of any special, expensive equipment, but depends upon use of tools which the cultivator possesses already. But the most significant point about it, from the point of view of this study, is that it has become popular mainly through the initiative of the cultivators themselves. An extension worker might have evolved the practice and extension staff might have had some part in popularising it. But it was obviously not evolved at a research station and was not propagated by the extension staff as an important recommended practice.

The mechanical maize-sheller is a simple device which consists of nothing more than an old melalhi barrel, fitted with wooden pedals, mounted on a horizontal wooden shaft. It operates with mechanical or bullock power. There are three such machines in the village, one of which is owned by an agricultural implement fabricator and the other two are owned by the two flour mill owners. These people undertake shelling of maize for cultivators at a higher charge of one seer, per maund (1 kg per 40 kg) of grain shell, ed. It was reported that about half of the maize crop of the village was being handled by these machines and that rice machines would be adequate to handle the entire crop. Here again is an instance of a simple machine evolved through local ingenuity which gives substantial benefits — saving of time, labour and a much better product.

One result of these technological advances is that the extension workers and the engineers working on improved implements have acquired a new hope and confidence. I had occasion to visit the agricultural implements workshop attached to the Agricultural University and to see the work being done on evolving improved implements like improved ploughs, a combined seed-cum-fertiliser drill and an improved hoe. Many of the improved ploughs and other implements devised at the workshop are improvements on the implements used by the cultivators earlier and have proved to be very popular. From discussions with these people it was clear that they had acquired the confidence that any impie-

<table>
<thead>
<tr>
<th>Table 8: Number of Implements</th>
</tr>
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<tbody>
<tr>
<td><strong>Ploughs</strong></td>
</tr>
<tr>
<td>Desi (unimproved)</td>
</tr>
<tr>
<td>Iron (improved)</td>
</tr>
<tr>
<td>Iron, furrow turning</td>
</tr>
<tr>
<td>Cotton drills</td>
</tr>
<tr>
<td>Maize shellers</td>
</tr>
<tr>
<td><strong>Tractors</strong></td>
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<tr>
<td>Chaff cutters</td>
</tr>
<tr>
<td>Manual</td>
</tr>
<tr>
<td>Bullock-driven</td>
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<tr>
<td>Motor-driven</td>
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<tr>
<td>Sugarcane crushers</td>
</tr>
<tr>
<td>Bullock-driven</td>
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<tr>
<td>Motor-driven</td>
</tr>
<tr>
<td>Bullock carts with</td>
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<tr>
<td>Wooden wheels</td>
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<tr>
<td>Pneumatic tyres</td>
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ment which was distinctly superior to the one used by the cultivator and met all his requirements would be accepted. This confidence is a very important fact.

At this workshop experiments were also being made with small tractors. The main objective of these experiments is to evolve a tractor which meets all the needs of a medium cultivator with a holding of 10 to 15 acres and which sells at a price which this cultivator can afford to pay. The engineers and some of the other specialists at the University were very confident about the success of these experiments. They felt that among the models available abroad there were some which could meet all these conditions and could with suitable modifications be successfully placed in the Punjab market.

USE OF IMPROVED SEED

The Punjab cultivator has long been familiar with the use of improved seed of some crops. Improved varieties of wheat like C-591 and of sugarcane like CO-312 were accepted several decades ago and have been in general use since. The most important change in this area during the last ten years has been introduction of longer staple ‘American’ varieties of cotton. The practice of growing American cotton was brought to the area by refugee cultivators returning from the canal colonies. It spread very quickly in the early 50s when it nearly replaced the shorter staple desi varieties. However, it received a set-back later, because the price differential in favour of the American variety was reduced and it was found that the American variety was more susceptible to disease. As a result both American and Desi varieties are now grown in the area. In this village, most of the cotton grown is of the American variety but as the figures in Table 5 show, the area under cotton has declined after 1956-57, partly because of damage from disease.

In case of wheat also the older C-591 variety has been largely replaced by a new variety, C-273 which is more resistant to disease, has bolder grain and consequently fetches a better price. The experience with the spread of this new variety is interesting, because it brings out the speed with which a new, distinctly superior variety can replace an older one. This variety was introduced by the Department of Agriculture about seven years ago and it is claimed by the extension staff that it almost replaced the C-591 variety in this block within a period of about four years. When one considers that one season must elapsed before the first demonstrations on cultivators’ fields can give results, this time span of four years is quite small and shows a high degree of receptivity of cultivators to improvements like improved seed with which they have long been familiar.

Another noteworthy development is that some of the more progressive cultivators are themselves looking for new varieties. One such cultivator had obtained from a cultivator in another block, seed of a new variety of wheat which was supposed to give very high yields with intensive application of chemical fertilizers. This new variety has not yet been released by the Department of Agriculture because experiments on it are still in progress. But this cultivator had obtained it on his own and during my interview with him, gave quite a sophisticated analysis of the economics of high yields with heavy doses of fertilizer. Another cultivator was experimenting with a new kharif fodder evolved by crossing bajra with napier grass which gives very high yields and is also very nutritious.

USE OF PESTICIDES

Use of pesticides is the latest among the improvements advocated by the extension staff, and is not as widespread as use of improved seed or of chemical fertilizers. This is due partly to the fact that the chemicals and equipment like power sprayers needed for spraying the crops are expensive and partly to the fact that chemical pesticides are ineffective in case of some important plant diseases of the area. Thus, there is as yet no chemical cure for the Gurdaspur borer which attacks sugarcane and causes heavy damage to the crop in some years. But, wherever the cultivators can use pesticides cheaply and effectively they are doing so. This is illustrated by the use of pesticides against storage pests. The practice of using BHC on grain kept in storage has been advocated by the extension staff during the last three years and the VLW claimed that it has already been adopted by the majority of cultivators in this village. Some of them mix BHC with the grain in the storage bin while others spray it by hand on the bags.

LIVESTOCK HUSBANDRY

The standard of livestock husbandry in the Punjab, has always been comparatively high. Some of the best breeds in the country like the Hariana bullocks and Murrah buffaloes come from the Hariana (south-east Punjab) area which is not far from this district. Moreover, recent technological changes in agriculture and rise in agricultural productivity have also contributed to improvement in the quality of livestock. Mention has been made above of improvement in feeding resulting from larger areas under green fodders, and of less strain on the working animal as a result of introduction of electric motors for lifting water. The bullocks and buffaloes now seen in the village would rank among the best in the country.

The villagers are also keenly aware of the value of good breeding. Two pure-bred bulls, a Hariana cow bull and a Murrah buffalo bull, are maintained by the panchayat through the traditional practice of being allowed to roam freely in the fields. Castration is universally done and early, in order to avoid indiscriminate breeding. However, artificial insemination has not become popular, even though this facility, which is available at the veterinary hospital in the block headquarters town can be availed of without difficulty. Certain other attitudes, e.g., towards treatment of disease and taking up commercial production of livestock products, also indicate that considerable progress has yet to be made before scientific attitude towards livestock husbandry and a commercial outlook towards production and sale of livestock products become widely established.

Treatment of Disease

The block headquarters town has a well equipped veterinary hospital. Similar hospitals are located in other towns at distances of 5 to 10 miles. Besides there are sub-centres in the larger villages. With this net-work of hospitals and sub-centres, facilities for treatment of sick animals and of breeding with animals of pure breeds are within easy reach of most villages. The veterinary doctor in-charge of the hospital explained that the hospital and sub-centres were quite popular with the villagers; that large numbers of animals were brought to these daily; that he and his assistants were called frequently in cases of serious sickness
of animals and that programmes of control of epidemic diseases like HS and foot-and-mouth disease were effectively organised from time to time.

While all this would be correct, another experience which I had, gives a revealing insight into the present attitudes towards treatment of livestock disease. During my first visit to the village, I was told that the tillage would be going through an out-break of foot-and-mouth disease, and that a special ceremony, a jag (from Sanskrit yajña or sacrifice) would be organised the next day to bring it under control. It was explained that a special messenger had been sent to a neighbouring town to obtain a charm (taweez) from a well-known practitioner of Chamars and that the ceremony would consist in collecting in the morning all the cattle of the village at its various gates, passing them through the gates, and sprinkling on them while they passed, water in which the charm and leaves and fruit of the neem tree had been dipped. They added that a large quantity of rice would be cooked at one place and distributed to all the house-holds in the village, and that no fire would burn, i.e., no cooking would be done in any individual house, and that no person would be either allowed to come into the village from outside or to leave it, on that day.

The jag was duly held the next day; but I was not able to witness it, because of the ban on entry of outsiders. The Sarpanch, an educated wide-awake man with extensive urban contacts, was a leading figure in organising the jag, and the other village leaders, most of whom are equally educated and wide-awake, took a prominent part in it. Even the young V.L.W., an excellent extension worker who was otherwise quite progressive in his outlook, appeared to share the villagers’ belief in the jag. When I mentioned celebration of the jag to the veterinary doctor, he admitted that celebration of such jags at the time of outbreaks of foot-and-mouth disease was common in the area. He mentioned also that villagers frequently resorted to treatments of this kind when their animals were sick, and that these treatments were often done simultaneously with the veterinary treatment obtained from hospitals.

**Dairying and Poultry Farming**

The attitudes towards commercial dairying and poultry production also show that the traditional prejudices against these are being overcome only slowly. There is widespread prejudice against sale of milk by cultivators in Punjab and adjoining states of Northern India. This prejudice has been weakening in recent years when, with the growth of urban demand for milk, sale of milk has become very profitable. In this area, the city of Ludhiana and other towns obtain most of their milk supply from villages, through vendors who collect milk in the villages and bring it to the towns on bicycles. The block headquarters town obtains its milk supply in this way. In addition, there is a large and growing demand for milk from the government dairy at the State capital. The dairy obtains its milk supply from milk producers’ cooperative societies, several of which are located in villages of this block.

This village sends milk to the block headquarters town, the quantity being estimated at between 120 and 150 kg daily. Besides, there is considerable sale of milk within the village itself. Most Mahajans and Mistris and many Harijans do not keep milch animals and buy milk, the quantity varying with the size and income of the family. Many jats also buy milk when their animals are dry. But commercial milk production is much less than it could be, and the prejudice against production of milk for sale among cultivators is partly responsible for this. It is significant that sale of milk was reported by only 5 people and three of these were non-fat, one Brahmin and two Harijans. Some village leaders mentioned that the number of milk sellers was in fact higher and that many cultivators, who were actually selling milk had not reported the sale, because of the stigma attached to it.

A milk producers’ co-operative society for supplying milk to the government dairy at the State capital had been formed in the village two years earlier; had worked for some time, and had then failed. Its failure was attributed by the village leaders to dishonesty and inefficiency of the staff attached to the milk collection centre located in the village. But later, when I discussed this subject again with them after having seen the successful operation of such a centre in a neighbouring village, they agreed that the main reason for the failure of the scheme was lack of interest in commercial dairying among the cultivators.

The same attitude prevails towards production of eggs for sale. The cultivators have no prejudice against consumption of eggs or other poultry products or against keeping some birds for meeting their domestic requirements of these. In fact, the practice of keeping birds for meeting domestic requirements has increased greatly in recent years, as the cultivators have become more prosperous. The U.L.W. estimated that as many as 75 families (mostly of Jat cultivators) keep rearing of poultry. But only one person had started commercial production in a small way, by keeping a flock of about 50 birds.

However, both successful dairying and commercial poultry farming were seen elsewhere in the block. Dairying was seen in adjoining village which had a co-operative milk producers’ society, supplying milk to the Government dairy at the State capital. The society has 20 members from the village, and in addition collects milk from non-members in other villages. The supplies range between 400 and 600 kg of milk daily. The members of the society were very satisfied with its working and explained that they received good income from sale of milk. Many of them had steadily increased milk production during the one year’s working of the society. It was an experience also to see delicate instruments like the Babcock butter-fat tester being operated by an old illiterate member. The Chairman of the society, a young man, educated and very progressive dairy farmer, was extremely enthusiastic about its working. He mentioned that the members of his society had recently bought 60 quality buffaloes from an adjoining district to increase their production of milk. His own herd of about 15 buffaloes was among the best in the block and two of his buffaloes had received prizes for high milk production. He explained that the average milk yield of a buffalo among the members of the society was 8 kgs per day (some of the buffaloes in his own herd yielded 16 to 18 kgs per day, at the peak of the lactation period), that one buffalo could yield a net profit of Rs 75 to 100 per month to its owner and that several members of the society with only 2 or 3 buffaloes were having incomes of between Rs 150 to 200 per month.

Commercial production of poultry was also seen in this village and elsewhere in the block. This is one of the blocks selected for intensive development of poultry in the State. As part
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of the poultry development programme a poultry extension centre and a marketing society were established at the block headquarters about a year ago. These provide all the assistance and facilities—one day old chicks to start a new flock, balanced feed, medical assistance, especially inoculation against disease like Ranikhet, incubators for hatching of eggs and arrangements for marketing of eggs and birds—which a farmer needs to start and run a poultry farm. The block has about a dozen poultry farms with flocks of 100 to 500 birds each, and the number is increasing.

The poultry farmer in this village was an educated young man, the son of a government officer, who had turned to poultry keeping about a year earlier when he was unable to get a suitable white collar job. He explained that he had obtained one day old chicks from the government poultry farm at Ludhiana and got technical assistance from the extension staff at the poultry extension centre. He was a member of the poultry marketing society, bought his feed and marketed his eggs through it. During the previous winter he had made good money by selling eggs for hatching to the I A D P people at Ludhiana. He mentioned that he could get a net income of Re 1 per bird and that he was making more money by keeping poultry than he would have made in any white collar job. He explained that he had started with about 300 birds in his own residential house, but was so satisfied with one year's working of his enterprise that at the time of my visit he was building a new, scientifically designed poultry-house outside the village, and was planning to increase his flock to 1,000 birds.

Later, I had occasion to see several other poultry farms, including one located at the block headquarters town, which was being managed by the wife of a white collar worker. This woman was keeping about 400 birds in the yard of her home. She had started keeping poultry about 3 years earlier, and her initial success had so encouraged her that she had bought her own incubator and had set herself up as a supplier of chicks to new poultry farmers.

Poultry farming is making rapid progress in the block and in the district. The number of poultry farms has increased during the last three years and will increase even more rapidly now, since it has caught the attention of the people. The main attraction is the high price of eggs in the markets of Delhi and the Punjab towns. The staff of the poultry extension centre and several of the poultry farmers themselves explained that the new, scientific method of keeping poultry, which had eliminated the risk of heavy mortality from disease, had made poultry farming quite profitable. Indeed, it has transformed poultry keeping which was a neglected branch of animal husbandry, to which attention was given only by the poor scheduled castes or the Muslims into a profitable enterprise.

But it is interesting to note that this new development of poultry is mainly in the hands of educated people. Some of them are cultivators, but others like the wife of the white collar worker mentioned above are non-cultivators. The enterprise requires a certain amount of capital and what is more, strict adherence to certain recommended practices, e.g., inoculation of birds at stated periods, balanced feeding, culling etc, which the average farmer still finds too tedious; but which the educated person can adopt easily.

The speed with which commercial poultry farming is spreading leads me to think that commercial dairying can also make similar progress. There are comparable advances in technique and similar facilities for marketing etc, made available. The main requirements for development of dairying are improving the milk yields of animals and more efficient organisation of milk collection. As regards the former, one specialist at the Agricultural University was of the view that through systematic breeding and improvement in feeding practices the milk yields of buffaloes in this area could be increased by 50 to 75 per cent within a few years.

### The Problem of Excessive Numbers

In any discussion on animal husbandry in India, the problem of numbers assumes prominence, because the number of cattle is much in excess of the requirements of agriculture and their low quality is considered to be due mainly to this fact. The prevailing practice in many parts of the country is that animals, especially cows and young stock, are turned loose on village pastures and other common lands and fallows, and subsist on whatever grazing is available in these. The situation in this respect is strikingly different in this village today. The numbers of cattle is not too large and the practice of grazing on common lands and fallows, never very important, has almost disappeared. The number of livestock at the time of this survey were reported to be as shown in Table 9.

Thus there were only 131 pairs of bullocks for over 1,100 acres of intensively cultivated, well irrigated land, which has a high intensity of double cropping. This number is not only not excessive; but appears to be barely sufficient for meeting the requirements of agriculture. The only other animals kept in appreciable numbers are milch buffaloes, which are the primary source of milk supply. On the other hand, the number of cows and young stock, which form such a large proportion of cattle in several other parts of the country, is comparatively small. One reason for this is that the cultivators do not attempt to be self-sufficient in their requirements of bullocks by breeding cows and raising young stock. They do not find this practice economical. The prevailing practice is to buy either mature bullocks or young calves of between 1 and 4 years of age, and to bring them up until they are old enough for work. Buying of young calves is preferred to buying of mature bullocks, because these are cheaper. These bullocks and calves are bought mainly in the mandis of the Haryana area, which are not far from here. Most cultivators do not rear buffaloes either. These are reared by Harijans or other castes like Bazigars, for whom it is an important source of income. Even buffaloes which have gone dry are often given by cultivators to Harijans to keep through their dry periods and are taken back, when they are in milk.

It is clear from this that the cultivator has a very practical attitude towards livestock husbandry. He keeps only those animals which are the most useful to him, and keeps feeding of unproductive animals or even of productive animals through their unproductive periods at a minimum. But the animals which he does keep, he feeds well. Unlike farmers in many parts of the country, he does not have the attitude of keeping large numbers of animals (and allowing them to starve) just because it does not cost him anything to do so.

### Table 9: Number of Livestock

<table>
<thead>
<tr>
<th>Livestock</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bullocks</td>
<td>262</td>
</tr>
<tr>
<td>Cows</td>
<td>89</td>
</tr>
<tr>
<td>Youngstock</td>
<td>123</td>
</tr>
<tr>
<td>She-buffaloes</td>
<td>261</td>
</tr>
<tr>
<td>Youngstock of buffaloes</td>
<td>107</td>
</tr>
<tr>
<td>Goats</td>
<td>109</td>
</tr>
</tbody>
</table>
This attitude is related to the fact that the practice of allowing the cattle to graze in pastures, etc, has been stopped and there is now almost exclusive reliance on stall feeding. Growing of fodder crops and stall feeding of cattle have been prominent features of the farm enterprise in Punjab for a long time; but in villages of this area, these have received further emphasis after consolidation of holdings and electrification of wells. First, with consolidation even the small areas of pastures which had been available earlier, were eliminated. Secondly, with the growing intensity of cropping, hardly any areas of fallow lands are available for grazing of animals. Thirdly, as explained earlier, with increase in irrigation and in agricultural productivity, cultivators now grow much larger quantities of green fodders.

Therefore, if the present phase of mechanization, i.e., electrification of wells, is followed by the further slope of introduction of small tractors, the presence of a large number of surplus cattle will not prove an intractable problem. The introduction of tractors will be accompanied by progressive reduction in the number of cattle through the simple process of cultivators selling their existing bullocks and not buying new ones. Buffaloes will continue to be kept however for their milk and their numbers may even increase, if commercial dairy-farming makes progress. The need for farmyard manure will then be met increasingly from the buffaloes. These developments will be similar to those in U.S.A and Western Europe, where the farm-work animal, the horse, has disappeared after introduction of tractors, and there has been a sharp increase in the number of cows of specialised dairy breeds.

ON THE EVE OF A TECHNOLOGICAL REVOLUTION

The picture which emerges from the above description is that of an agricultural community in which there has been notable advance in methods of utilisation of resources and a process of rapid adoption of improved agricultural practices is well under way. This process began with consolidation of holdings, which was followed by a rapid increase in the number of irrigation wells and electrification of most of these. These three developments made possible a more intensive cropping pattern, more adequate irrigation and care of all the crops grown, and increasing attention to adoption of recommended improvements notably use of chemical fertilizers. Much progress still remains to be made in intensifying agriculture and extending adoption of improved practices to all the farmers. The use of chemical fertilizers for instance, could be increased ten-fold before the levels considered adequate by the agricultural scientists are reached. But a stage has now been reached when adoption of improved practices has become part of the agricultural enterprise of the average farmer: when proved improvements tike improved seeds of several crops, and nitrogenous fertilisers are adopted by the majority of the farmers, and a new seed variety or a new fertiliser takes only a few years (3 to 5) to get widely accepted. There are farmers in these villages who are not only ready to adopt recommended improvements; but are themselves looking for these in an effort to increase their production and incomes. Their number is small; but their presence has an influence which is far greater than their numbers. Further, beginnings of highly specialised types of commercial farming or livestock enterprises, like commercial poultry production, have already been made.

The area is now ready for larger changes, which would bring about major changes in farming techniques and make farming significantly more specialised and commercial. Expansion of poultry farming and of commercial dairying; much larger and more scientific use of commercial fertilisers and pesticides; large scale introduction of the small tractor and mechanisation of a variety of agricultural operations will be some of these changes. The successful experience with technological change has put the farmers in a mood in which a large number will be ready to adopt these larger and more fundamental changes. The economic level of the upper half of the tanners (those with holdings above 10 acres) makes it possible for them to be receptive to these changes, and there are no problems like that of a large number of unproductive cattle, which would present insuperable obstacles in the adoption of these.

(To be Continued)