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AGRICULTURAL LABOUR IN CHIRCHITA VILLAGE, BULANDSHAHR, UTTAR PRADESH : LABOUR AVAILABILITY AND PEAK DEMAND*

Problems of Assessing Fluctuating Agricultural Activity, and a Possible Solution

The problems of estimating labour input in agriculture are familiar to all those who have attempted to record acceptable estimates of labour input, especially in peasant communities in Asia and Africa. Illiterate farmers do not maintain formal records, and even farmers with larger holdings, who depend less on family labour and more on permanent and temporary wage labour rarely keep accounts which indicate the numbers of labourers employed.

We have also found it impossible to rely on estimates of the size of the labour force recalled by farm operators for any period in the past, even the immediately preceding season. It is extremely difficult, for example, to estimate the average numbers employed over even the relatively short periods of peak labour demand at seasons of land preparation or harvesting which can occur in one, two or even three cycles in areas of multiple cropping. There are other problems associated with the collection of labour utilization data by means of questionnaire survey. Not only is it difficult to convey to the farm operator the concept of 'average' labour employed over a specified period, whether the period be a day, a crop season, a harvest period or an agricultural year, but it is also difficult to frame questions which yield meaningful measures of the labour utilized.[1] How useful is it to ask questions concerning the maximum and minimum number of agricultural labourers engaged at particular seasons, without also attempting to determine for how many days or weeks elements of this essentially fluctuating labour force are employed ? Conventional questionnaire studies make enquiries about

1. There are numerous examples of attempts to seek average figures for hours worked in 'busy' or 'slack' seasons. It will suffice to quote a study of the district adjacent to that which we shall be examining later. R. C. Saxena : Agricultural Labour : Wages and Living Conditions in Meerut, Bombay, 1969, p. 390. The questionnaire poses such as "What are your usual hours of work on the farm ?—in the busy season—in the slack season ?" That no results are quoted in the report of the study for the distribution of agricultural work through the year would indicate that it proved impossible to enumerate the very detailed monthly schedule set out on p. 388, which was designed to elicit from farm labourer their allocation of employed/unemployed time during the twelve months of the year. It is also interesting to observe the extremely complex assumptions necessary to arrive at some estimates of seasonal labour requirements in a Bihar study by J. P. Bhattacharjee, "Underemployment among Indian Farmers : An Analysis of Its Nature and Extent Based on Data for Bihar," *Artha Vijnana*, Vol. 3, No. 3, September, 1961 and reprinted in A. M. Khusro : Readings in Agricultural Development, Allied Publishers, Bombay, 1968. The assumptions are so extensive, and the estimates of the working day at various seasons so approximate that his conclusions concerning seasonal labour requirements and related under-employment must be approached cautiously.

the conceptualised 'average labourer' (male, female and child), and it is difficult, if not impossible, for farmers to relate to such an average personality.

Other qualities of the labour force are often sought retrospectively by questionnaire survey; for example, the degree to which the labour force is composed of family labour, permanent labour or casual labour, also the method of remuneration, extent of supervision and the amount of rest taken by the field labourers. But perhaps the most important feature which labour studies in peasant societies seek to establish is whether or not in a particular situation, or area, a shortage of labour is a possible constraint upon further agricultural development, or on the other hand, a labour surplus might become a source of political unrest.[2]

The problems of accurately quantifying labour input are clearly considerable. There is, however, a technique of work measurement which can be used over a variety of time periods to assess many aspects of the working situation, or at least those aspects which can be observed. The technique, activity sampling, has been applied extensively in industry and commerce, and has been described by Barnes (1957), Heiland and Richardson (1957) and Hansen (1960).[3] The purpose of the technique is to provide data on activity by means of observations arranged at random times. Information on the amount of time allocated by individuals or groups to particular activities over a time period can be gathered, and the confidence with which such data can be quoted, may be statistically assessed. The technique can be applied to any time period, the only limitation being the availability of observers.

We have indicated already that the technique can only cope with *observable* aspects of activity, and not with remuneration, nor with such aspects of the labour force as its age or social background.

The technique has a number of advantages, however. A large number of working locations can be observed by a single enumerator, as they can be visited systematically, while still maintaining a random observation time for each location. Further depending on the terrain and the transport available, studies can be completed which include large areas, or at least a series of working situations which could not normally be recorded by a single observer. Thus in a rural case the fields owned by the residents of a single village, or group of villages could be sampled spatially and then visited at selected random times. In areas of suitable topography it might be possible to use the technique from a vantage point, completing the observations both discreetly, and with no movement in 'the field.'

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2. Francine R. Frankel : India's Green Revolution : Economic Gains and Political Costs, Princeton University Press, Princeton, New Jersey, 1971, pp. 37-38. Attention is drawn to the problems of labour shortage in 'progressive' districts, arising from a general intensification of farming, and new limitations on the period available for the harvesting of wheat, with 'high-yielding' varieties requiring the completion of harvesting in 10-15 days compared with 20 days or so for local varieties.

3. Ralph M Barnes : Work Sampling, John Wiley and Sons, New York, 1957; Robert E. Heiland and W. J Richardson : Work Sampling, McGraw-Hill, New York, 1957; and B. L. Hansen : Work Sampling for Modern Management, Prentice Hall, Englewood Cliffs, 1960.

An important advantage of activity sampling is that the observer can generally carry out his recordings without disturbing the activities in which he is interested. There is always a danger in studies of people at work that they will change their activity or rate of activity when they realise that they are being observed.[4] Activities which can be observed at a distance are perhaps, therefore, best suited to the technique such as described in the following case study completed in the field in March-April, 1972, during the *rabi* (winter) harvest season, in the village of Chirchita in the Bulandshahr district of Uttar Pradesh, approximately 80 km. east of Delhi.

The study was part of a larger project designed to determine the extent and rate of adoption of high-yielding varieties of wheat and the relationship of physical and socio-economic variables, in the district of Bulandshar (population 2,074,816, area 4,900 square kilometres approximately, population density 424 per square kilometre).[5] Uncertainty about the questionnaire method of obtaining information concerning labour input, especially with reference to the season of peak demand, the *rabi* wheat harvest, was confirmed at the pilot study stage when farmers were unable to recall even such an imprecise measure as the maximum number of temporary labourers employed for the previous harvest, and while not being unhelpful, they were unwilling to guess a figure which they knew would be very inaccurate.

It was decided therefore to attempt to obtain some indication of the labour requirement by the technique of activity sampling with direct observation throughout the period of the harvest. This study was also to be an experiment to discover field problems and the general practicability of the method.

The Case Study Village

It was necessary to limit the study to one village as staff and resources were only available for the field work estimated to be necessary for the enumeration of a sample of the plots from one village. The accessibility of the village to observers was a consideration, also the favourable attitude to our work of farm operators and labourers in those villages which were accessible. The village of Chirchita, which covers 344 hectares, was finally selected, and 35 plots were measured and marked on the village map, being

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4. The Hawthorne studies at the Western Electric Company in the U.S. in the 1920s indicated conclusively that operators perform in an *unusual* way, when attempts are made to isolate them from their *usual* working situation, or when a group receives special attention and supervision. Predictable increases in production were achieved when working conditions were improved, and a series of changes in decoration, lighting, etc., all brought some increases in production. However, when conditions were made similar to those at the outset of the experiment, production again increased. This example is included to indicate the dangers inherent in the process of observing and recording working activity. It might be added that such evidence raises doubts about the validity of much field research of an anthropological, economic or geographical nature, in that the presence of the field worker(s) clearly affects the situation being observed. The sensitivity concerning intrusion by other scholars of most of those who engage in field work, and their territorial awareness of their particular study area, is possibly an unwitting confession of the unrepresentativeness of much that is recorded.

5. Census of India 1971, Provisional Population Totals, Paper 1 of 1971 Supplement, Delhi, 1971, p. 150.

the plots selected previously at random to identify sample farm operators for the main district study. There was available, therefore, a considerable body of additional data relating to soil quality, irrigation water and the socio-economic condition of the farm operators whose plots we were studying.

The District Census Handbook[6] for Bulandshahr shows that in 1961 the total population of Chirchita was 1,097 (male 578 and female 519), of whom 343 were identified as workers, and of these, almost all were engaged in agriculture either as cultivators (257) or as agricultural labourers (26). Between 1961 and 1971 the rural population of the district increased by 18.49 per cent,[7] and we can assume that by 1971 the total population of Chirchita had increased by approximately the same rate to 1,300, and the agricultural labour force to approximately 335. The average density of population was therefore 379 per square kilometre in the village, which was lower than the district level of 424 persons per square kilometre.

Our purpose was not to sample the farm operators in this case,[8] but to estimate the labour input for the area under wheat, wheat being the dominant crop in the area. The data from the main study for neighbouring villages indicated that 65 to 75 per cent of the area of the farms was allocated to the raising of wheat during the 1971-72 *rabi* season. The total area under wheat in Chirchita (total area 350 hectares) can be reasonably estimated as 250 hectares, taking into account waste, other crops, and fallow land.

It is important to draw attention to the predominance of wheat in the *rabi* season in the study area. Not only does it cover the main proportion of the farmed land, but it is the major commercial crop,[9] especially since yields have increased and the government has maintained its strong price support policy. (Wheat realised between 72 and 76 rupees per quintal in 1972.)

A random sample of wheat plots was selected, using a map which exists for Chirchita (part of a series for Bulandshahr district) showing all *chaks* (*i.e.*, post-land consolidation plots) with serial numbers against each *chak*. Field work for the main study had already been completed and thus we knew the crop in each of the *chaks*. Out of the 45 plots originally selected, 35 were identified as being under wheat, as well as being conveniently located for field work. This sample of plots would indicate that almost 80 per cent in the district, and higher than in the neighbouring villages.

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6. Census of India, District Census Handbook, Bulandshahr District, Lucknow, U.P., 1965, p. lvi.

7. Census of India, Provisional Population Tables, Series-1, India, Paper 1 of 1971, Supplement, 1971, p. 150.

8. In the main study it had been our purpose to enumerate a representative sample of farm operators.

9. Directorate of Agriculture, Uttar Pradesh, *Bulletin of Agricultural Statistics for Uttar Pradesh, 1969-1970*, Lucknow, 1972, pp. 69-72. It is shown that for the district as a whole 65 per cent of the reporting area was under wheat in 1969-70.

The sample covered approximately 6.4 per cent of the total area under wheat. It reflected the village community by including 26 plots run by Jat operators, 8 by Muslims and one by a Brahmin. The Jat operators in this village manage larger farms than farmers from other communities, and it also appears that many Jats manage a number of plots. Although 26 Jat managed plots were observed they were operated by only 20 farmers. It should be added that although 73 per cent of the observations were of Jat managed plots, and 69 per cent of operators in the sample were Jats, it was estimated that only 39 per cent of the total population of the village were Jats.[10]

In addition to sampling spatially, it was also necessary to arrange a sample representative of the period of the harvest. It was estimated that the harvest would take between four and six weeks, and in the event it took five weeks and two days (37 days).

A preliminary examination of the disposition of the plots to be observed showed that it would take a team of three people to observe each plot up to four random times each working day, assuming a possible start at 06.00 hr. and finishing time of 18.00 hr. Table I has been included to show how the sample size (total observations) varies according to the length of harvest if the observing schedules outlined above were maintained.

TABLE I—NUMBER OF OBSERVATIONS RESULTING FROM VARIOUS PERIODS OF STUDY OF 35 PLOTS

No. of days	Observations per day	Total observations
28	4	3,920
35	4	4,900
42	4	5,880

Table II indicates the 'absolute' accuracy[11] which can be obtained using these sample sizes and the confidence limits which can be quoted. Thus if an activity was to take up to 20 per cent of the time covered by observations (a likely maximum) the results could be quoted as follows for the respective samples:

TABLE II

No. of days of study	Sample size at 4 observations per day	Accuracy of results for an activity which occurs in 20% of the study period
28	3,920	± 1.3% at 95% confidence limits
35	4,900	± 1.1% at 95% confidence limits
42	5,880	± 1.0% at 95% confidence limits

10. Precise data were not available. The figure of 39 per cent was deduced from conversations during numerous visits to Chirchita.

11. Figures in such tables which can be found in various texts on activity sampling quoted previously are based on the formula (itself derived from the standard error of a percentage):

$$N = \frac{4P(100-P)}{L^2}$$

where
P = percentage occurrence of activity,
N = number of observations,
L = degree of accuracy.

On the basis of these estimates it was decided to proceed with the scheme of four observations per day during the period of the study, and even if the harvesting was completed in four weeks satisfactory data would still be available. The main intention of the field study, however, was to assess the *method* of observation in an agricultural situation.

The Method of Field Observation

Enumeration was necessarily carried out during a period of the year when temperatures of over 40°C were usual. Field work, especially during the middle of the day, was therefore arduous, and so a team of three observers was used. The observer completed two rounds of the plots in the morning and another carried out two more rounds in the afternoon. By having a third observer it was possible to arrange rest days for the observers and provide against their sickness, as well as maintain a seven-day observing schedule. Pilot circuits of the plots were completed and it was found desirable to make circuits by bicycle. In order to ensure that the observations were made at random times, the start point in each circuit was determined by taking a random plot serial number (1 to 35) and then moving round the circuit, back to the starting point in the same direction on each occasion.

The activities observed were divided as follows: cutting, other field activities (*e.g.*, bundling, carrying), and resting, and the numbers of men, women and children were shown separately. The presence of carts, threshers and other equipment was also recorded.

Results of the Study

Concerning the period of maximum demand for labour, the evidence from this study in 1972, indicates that the harvest extended from 20th March until 25th April (37 days) in the village of Chirchita. The harvesting of the sample plots was completed in 27 days between 24th March and 19th April. In relation to the two periods of 37 days (5,180 observations) and 27 days (3,780 observations), the accuracy of results can be quoted at 95 per cent confidence limits to ± 1.1 per cent and ± 1.4 per cent respectively.

The arrangement of labour input was by no means regular through the harvest. Over 60 labourers were engaged in harvesting on 31st March during the busiest day on the sampled plots and on 13 days out of these 15, between 24th March and 7th April, 20 or more labourers were working on the sampled plots. Evidence does point to a concentration of labour input, but over a slightly longer period than that originally expected.

In order to discuss the second proposition relating to the possible shortage of labour in the study village, it is necessary to make certain assumptions, and so a rigorous testing of the hypothesis is not possible. We must first assume that in the 15.5 hectares sampled we have 6.4 per cent of the estimated 250

hectares under wheat in Chirchita in the *rabi* of March, 1972. We must also make assumptions concerning the possible allocation of harvest labour within the village. It will, for instance, be assumed that the average number of 28 labourers per day engaged in harvesting during the busiest 15 days reflects the maximum demand situation. A crude extension of this figure of 28 labourers per day on the sampled 6.4 per cent of the wheat area, to the total 250 hectares in the village suggests a total peak requirement of 452 labourers. This figure exceeds an estimate of the agricultural labour force of 335, quoted earlier; but it is likely, however, that the figure of 335 under-states the availability of family labour, especially as the original source of the data, the 1961 Census shows the female element of the agricultural labour force to be under two per cent, whereas field observation indicated that 18 per cent of those harvesting were women, and a further 5 per cent were children. According to the above assumptions concerning the concentration of harvesting into a period of approximately 15 days, there would appear to be sufficient labour in Chirchita village provided women continue to participate in the field. It should be noted that there are some communities in the district where it is not usual for women to take part in agricultural work. In these villages, it is likely, therefore, that there would be insufficient labour to complete the work at the optimum time in terms of crop ripeness.

The problem of estimating the maximum labour requirement can be approached in a different way. The sample study indicated that a total of 442 man-days[12] was worked by agricultural labourers in gathering the crop on 15.5 hectares, reflecting an average of 28.2 man-days per hectare; at this rate, the 250 hectares of wheat of the village would require 7,050 man-days of harvesting, and over a period of 15 days this points to a labour requirement of 471 labourers. Since it is known that the harvest extended over 37 days in this village, and that we can assume a labour force including women and children of upwards of 400, it seems that this second assessment also indicates that there is no labour shortage in Chirchita. It does show, however, that at present rates of output per labourer there is not a large surplus of labour in the village, and therefore there is a need to preserve a co-operative atmosphere between the communities in the village, as well as between the farmers who hire labour and the hired agricultural labour force.

Before leaving the subject of the supply and demand for harvest labour, reference should be made to the allocation of activity to the various tasks of harvesting as observed during the study. The major activity is that of cutting which engaged people in the fields for 48 per cent of their time; other activities mainly bundling the cut wheat took 33 per cent of their time and the remaining 19 per cent was spent in resting. It is also interesting to observe that in terms of the periods spent in the fields the element of rest was different for men and women, with men taking 21 per cent of their hours as rest while women took only 11 per cent.

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12. A man-day is taken in this case to mean up to 12 or more hours of work undertaken in one day by one man.

There is, however, one feature of the organization of the harvest which is helpful in understanding how society functions in Chirchita. The study showed that the wheat harvest tended to be gathered sooner on the Muslim owned plots, and with the expenditure of fewer man-days per hectare. The dominant caste of the village is the Jat community, and this dominance is reflected in the ownership of over 70 per cent of the holdings although the Jat families composed only 39 per cent of the village population. The Jat farmers have the further advantage of holding the areas of good soils and have access to more effective irrigation facilities. There was some evidence that the Jat farmers tended to be more active during the peak days of the harvest (31st March—2nd April), but in no other way could the pattern of activity of the two communities be distinguished. Their inputs of labour were equally variable within the caste groupings, as were the overall days of the harvesting on particular plots.

The influence of the quality of the holdings of the respective groupings is an important consideration, however. The generally poor yields on the Muslim held plots would contribute to the shorter harvesting periods on these plots in that less hours would be required to cut and gather the lower yielding wheat. The pattern of land ownership is also reflected in the timing of the harvest in various areas of the village, with plots to the north and east being harvested first, these being the plots owned by the Muslims.

The significance of mechanical assistance and of supervision can be treated briefly. Most of the harvest was transported to the village for threshing and storage by means of head loads. It is estimated that approximately 35 per cent of the crop was moved by cart, with eight out of the 35 plots being served by carts and these eight plots being above the average size for the village and belonging to the cultivators with larger than average holdings. This level of use of animal transport gives some measure of the likely effect of the further introduction of even simple means of transport. There was apparently no such requirement in 1972, nor does a requirement seem to be likely in the short-term, but it is clear that the labour supply position would be changed dramatically by the more widespread use of the simplest mechanical transport. Very little threshing was conducted in the fields, with only one machine evident on the sample plots during the study. This operation was completed in the village.

In order to observe the effect of the presence of supervision, one plot was observed throughout a whole day of harvesting activity. These data show that the presence or absence of the supervisor was significant with respect to the rest periods of the harvest labour, in that the number of resting labourers rose during the absence of the supervisor. In addition there were distinct changes in activity upon the return of the supervisor after his absence. However, this is not a labour-short community and so the length of time taken to gather a crop with harvest labour is not crucial, especially as the method of remuneration of the hired labour is related to the amount

cut and bundled. The hirer is protected from poor rates of harvesting by his hired labour as labourers are entitled to receive a proportion of the crop. In 1972 the proportion ranged from 5 per cent to 10 per cent of the amount gathered, and this was the same as during the preceding *rabi* harvest. The presence of the owner and supervisor was to be expected, however, as the crop was liable to theft, or the bundles to be disadvantageously assembled if he was not around to attend to his interests. As 80 per cent of the cultivators in Chirchita hired labour in order to gather a part or all of their wheat harvest, the potential contribution of supervision to the conduct of the harvest is clear.

Conclusions and Comments on the Research Method

A number of important features of harvesting activity has been revealed by this study of the wheat harvest, which is the peak labour demand season in Chirchita and elsewhere in western Uttar Pradesh. The harvest extended over four weeks, and was concentrated in two weeks, with a clear peak during three days (31st March to 2nd April in 1972). There was no labour supply problem in this village and it is unlikely that such will emerge in the foreseeable future, so that mechanization even of transportation may be undesirable in that it would reduce the opportunities for hired labour to gain employment. The organization of harvesting was to some extent related to the size of holding and plot size, indicating that harvesting practices conform generally to the ideas of returns to scale identified in other studies.[13] Large farmers dominated the labour market especially during the preferred peak days, but they also tended to harvest at a lower rate per hectare than the small operators, and extended harvesting into the later period of the harvest. Caste proved to be the main variable which gave a basis for distinguishing different patterns of activity amongst the cultivators of Chirchita. The Jat community, with its holdings located on the best soils of the village obtained higher yields and tended to gather the crop during the peak of the harvest period. The Muslim farmers tended to cut their wheat before the peak and to organize the completion in a shorter period by harvesting more intensively.

The main purpose of the study was to establish the viability of the research method especially from the point of view of field operation. In this connection activity sampling has been shown to be applicable in the 'agricultural' and 'developing world' contexts. The method of sampling allows a relatively large 'population' to be observed economically, and further it would facilitate the completion of sequential and comparative studies.

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13. A. M. Khusro, "Returns to Scale in Indian Agriculture," *Indian Journal of Agricultural Economics*, Vol. XIX, Nos. 3 and 4, July-December, 1964.
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