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# SPATIAL ORGANIZATION OF AGRICULTURE IN A NORTH INDIAN VILLAGE A BEHAVIOURAL APPROACH

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**ABSTRACT** : A behavioural approach explains spatial organization of agriculture more exhaustively than the environmental and the economic approaches. Despite that it has never been applied to an Indian situation. A modest attempt in this paper has been made to explain spatial location of crops in a north Indian village through the decision process of the farmers. A two-stage decision-making model on a farm is an outcome of this investigation. The first stage of the model deals with the selection of crops and the allocation of area to each one of them. The second stage relates to the selection of a field for a specific crop. The decision-making models forwarded earlier confine themselves to the first stage. The second stage of the model proposed here is a special contribution of this study.

Spatial pattern of agriculture may be explained through environmental forces. economic principles and human behaviour, ( Minshull, 1975 ). During the first half of this century a period of environmental determinism and area studies- agricultural patterns were largely explained through physical factors, such as climate, relief and soil. The nature of papers published in *Economic Georaphy* during the 1920s and 1930s clearly indicate this trend ( Jonasson, 1925; Baker, 1926; Jones, 1928; Taylor, 1930 and Valkenburg, 1931 ) A great deal of emphasis, in these monumental works was laid on the establishment of causal relationships between the agricultural use of land and the physical forces. They are highly informative. Owing to their general and descriptive nature, these studies, however, are less productive of theory.

The economic approach strives to explain spatial locations through economic principles. It received a maximum fillip in the 1950s and 1960s. Von Thunens's theory of agricultural location came under thorough scrutiny during this period ( Dunn, 1954; Losch, 1954; Garrison and Marble, 1957. Chisholm, 1962; Peet, 1969; Horvath 1969). Based on the distance-cost relationship; this theory, like other economic theories, banks heavily on the concept of 'economic man'. An economic man is one who has complete knowledge of physical and economic environments and acts rationally in accordance with economic principles. The farmers, however, are not supermen, but are ordinary human being whose behaviour departs significantly from that of an economic man. They are satisfaction-rational rather than economic-rational (Simon, 1952; Harvey, 1966). Satisfaction, of course, is directly related to income. But it is not the only yardstick with which this human attribute is measured. Personal qualities, such as the desire for leisure, an urge to maintain traditional and religious values, ability, experience, aim, age, perceptions and strategies of individual farmers play a significant role in the spatial organization of this basic economic activity. The increasing realization of this fact since the mid-sixties has led to the emergence of the behavioural approach.

The behavioural approach explains spatial organization of agriculture through the decision making process of the farmers. A pattern of agricultural location, after all, is the end-product of a large number of indivdual decisions (Harvey, 1966) A particular crop has come up in a field simply because the concerned farmer has decided to raise it there. In a prevalling physico-socioeconomic and technological situation, it is the farmer who selects or rejects a crop, a crop combination or a crop-livestock enterprise. It is he who takes a decision about the allocation of his farmland in various proportions to different crops and selects a field for a crop. Spatial organization of crops over a farm is the best expression of a farmer's mind. It is the net result of all the forces (physical,economic,human and technolgical) operating in his mind. Thus, the explanations sought through the decison process of the farmers, are more exhaustive of spatial reality than those furnished through physical forces or economic principles. The behavioural approach is all in one. Secondly, by virtue of its micro-areal investigations, this approach is more productive of concepts and theory. The purpose of this paper is to explain the spatial organization of crops in a village located in northern India through the decision process of the farmers and to propose a two-stage decision making model on a farm.

**The Village**

Devinagar Hirasinghwala ( hadbast no. 265, Tahsil and District Patiala. Punjab, India), the village under study, is located in the flood plain of the Ghaggar at 30-7N and 76-31E. It receives an annual average rainfall of about 63 centimetres. Nearly 80 per cent of it comes during the rainy season1 (July, August and Septemper). Besides being highly concentrad, the rainfall is variable and inadequate. The village has fertile clayloam soils and a rich reservoir of underground water. The southern one-third of the village land is flooded by the Tangri Rivulet (a tributary of the Ghaggar ) during the rainy season. It causes serious damge to the *Kharif* ( summer monsoon ) Crops. Patiala, the nearest market city, is located at a distance of 28 kilometres from the village. Inhabited by 261 persons (1971), Devinagar Hirasinghwala covers a land area of 198 hectares out of which 186 hectares is under net cultivation. Almost the whole of its cultivated area is irrigated. Nearly three-fourth of its irrigation water is provided by tube-well / pumping-sets and the remaining one-fourth is irrigated from canals. Under inadequate and unreliable rainfall, the performance of a crop in the village depends upon irrigation. There are 37 cultivating households, out of which 33 live in the village. The remaining 4 dwell in the neighbourin,villages.On an average, each cultivating household owns 5·3 hectares of farmland. The actual size of the landholdings, however, varies from 2 to 18 hectares. It is an owner-cultivated, highly commercial, progressive and fairly mechanized village. It has 14 tractors along with necessary implements and threshers for performing farming operations. Because of its distant location from the market, intensive farming activities, such as poultry, dairy, piggery and vegetable-raising could not come up on a commercial scale. Its economy is based on cereals.

**The Data**

This study is based ou the cropping pattern of 1979-80. In the first instance, an outline field map of the village was obtained from the village revenue official *(Patwari)*. The location of tube-wells / pumping-sets and individual landholdings were marked on this map by visiting the fields and consulting the concerned farmers. The fieldwise ocation of each crop of both the seasons

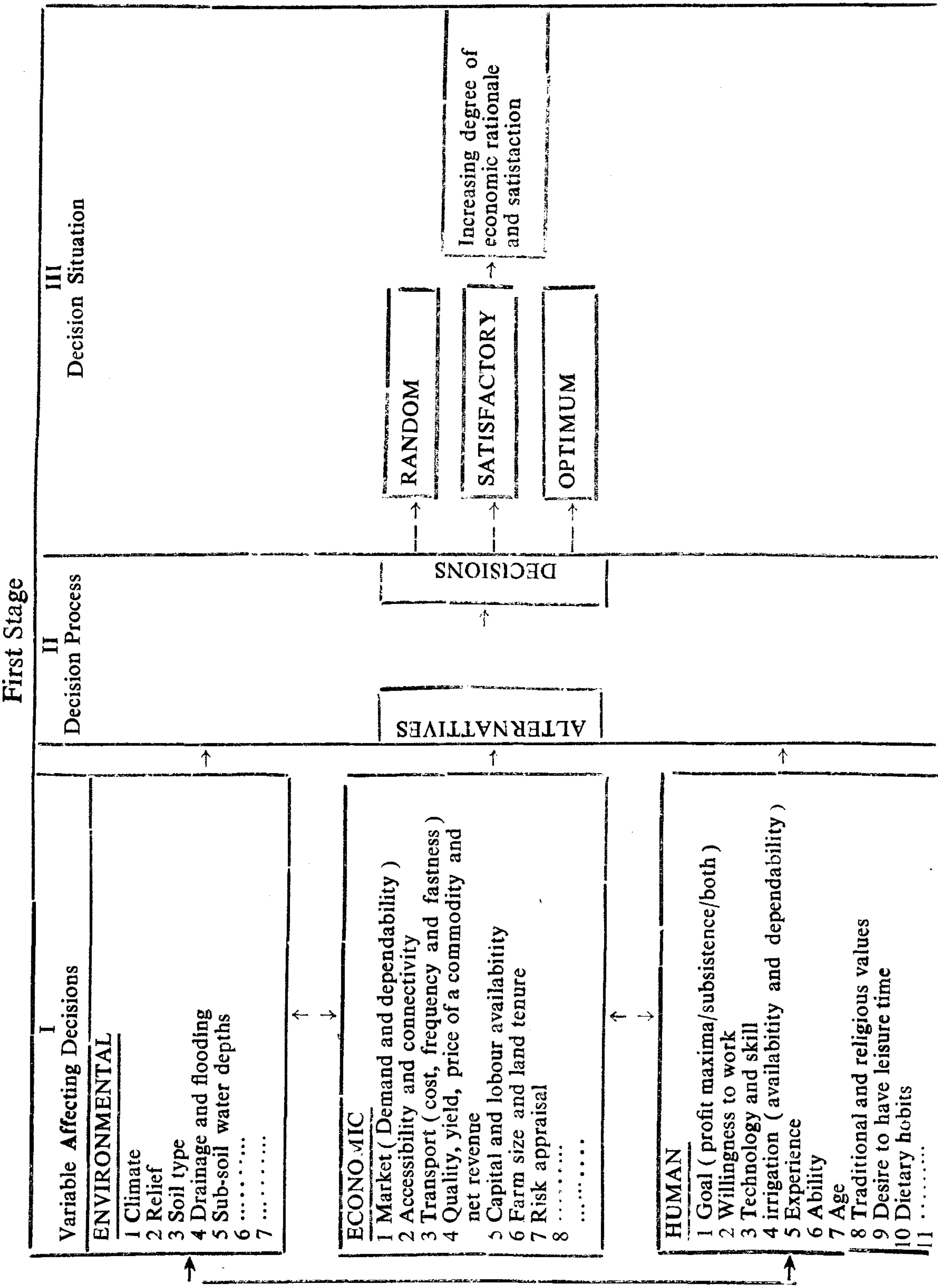


Fig. 1. This stage of the model deals with the selection of crops and allocation of area to each of them.

( *rabi and kharif* ) was brought on this map by surveying the village at the time of standing crops. The reference map, thus prepared, and, a querstionnaire were used for investigating the decision process. The query was designed to explore decision making at two levels : ( i ) Why has a crop been selected and allocated a specific proportion of area on a farm ? ( ii ) Why has a farmer decided to raise a particular crop in a particular field ?

**Decision-making and the Cropping Pattern**

The cropping pattern is a function of the selection of crops and the allocation of area to each one of them by the farmers. It is an ultimate out-come of the first stage in the decision-making proeess on a farm ( Fig. 1 ).

Physical forces, beyond doubt, have played a vital role in the selection of crops in the village. The farmers have picked up only those crops which the environmental conditions permit. Selection, however, is not done every year. The repeated cultivation of a set of crops over the years has clearly demonstrated the suitability of a habitat for them. Their choice thus, has become a routine matter. The allocation of area to the selected crops has been the result of a combination of physical, economic, human and technological faetors. The prevailing physical setting permits a fairly large number of crops. Nature, however, is more conducive to some than to others. Those crops, which do better, have been allocated larger areas. Another major consideration in this connection has been the net profits. In the prevailing techno-economic situation the crops which bring higher net income have been given the greater share of the cropland. The survey revealed that each farmer of the village had two economic aims ( i ) self-sufficiency in domestic requirements and ( ii ) the maximization of profits. Every farmer has spared small proportion of his farmland for those crops which he needs for the consumption of his family. A larger part of the remaining land, however, has been devoted to those market crops which bring geater net profit. The ratio between the commercial and the subsistence crops largely depends upon the farm business and the family size Nearly 90 per cent of the total cropped area of the village has been devoted to wheat and paddy. These are the most outstanding market crops. The remaining 10 per cent of its cropland has been apportioned to the subsistence ( grown for domestic consumption ) crops, such as lentil, gram, fodder, vegetables, linseed and sugarcane (Table I ).

Wheat occupies nearly 88 per cent of the

**Table I**

**The cropping pattern of village Devinagar Hirasinghwala : 1979-80.**

| Crops | Percentage area | Crops | Percentage area |
|---|---|---|---|
| **Rabi** | | **Kharif** | |
| Wheat | 88.0 | Paddy | 92.2 |
| Clover | 4.2 | Sorghum vulgare ( **Jowar** ) | 6.2 |
| Lentil | 2.7 | Vegetables | 0.4 |
| Gram | 2 2 | Cotton | 0.3 |
| Vegetable | 1.0 | Scgarcane | 0.3 |
| Linseed | 0.7 | Others | 0.6 |
| Sugarcane | 0.5 | | |
| Others | 0.7 | | |

winter cropland of the village. Suitability of the habitat and highe reconomic returns *vis-a-vis* other crops of the season encou raged the farmers to raise this crop on an extensive scale. Development of the high-yielding varities of wheat and an assured market created for this commodity by the government through state trading and support price have given it an economic edge. The availability of irrgation water essential to the raising of high–yielding seeds, and a considerable use of form machinery, especially designed to facilitate the cultivation of wheat, too have played a positive role. Besides, wheat is a traditional crop. Through generations of association, the village folk have not only mastered the techniques of its cultivation but have also developed a special taste for this cereal. Its cultivtaion has become an essential part of culture of the people and the glimpses of that culture may be seen through thc folk-dances ( *bhangra* and *giddha* ) and folk-songs of the state. Under the prevailing situation, no winter crop matches wheat in the suitability of habit. the yields per hectare and the cash returns. It is the most important commercial crop of the season. Nearly85 per cent of the total wheat produce of the village is sold for cash. Lentil ( masoor ) and gram are the other notable crops of the *rabi* season. Both cover 2.7 and 2.2 per cent of the winter cropland of the village respectively. They are sensitive to excessive soil moisture and suffer seriously if winter rains are heavy. On the other hand, wheat is tolerant of greater moisture range. Thus the risk involved in growing lentil and gram is higher than that of wheat. Also, under the pervailing market mechanism, lentil and gram yield less net revenue than wheat, even if weather conditions remain ideal for them during a year. Being fully conscious of these natural and economic realities, the farmers have decided to devote a smaller proportion of their farmland to these two crops. They are grown only to meet the domestic needs. Similarly, the cultivation of mustard and linseed has been kept on a subsistence level. Covering 2.5 per cent of the winter cropland, clover is the most commonly grown fodder crop of the village. This crop is capable of ratooning. It gives six to eight cuttings per sowing. No other fopder crop af the season has this quality. Thus, its yield per hectare is higher. Its nutritive value is also fairly high. These two factors coupled with a substantial development of irrigation, essential to meet its higher water needs, encouraged the farmers to opt for this fodder crop.

Paddy commands a unique position among *kharif* (monsoon) crops of the village. It occupies 92 per cent of the season's cropland. Hot and wet climate during the summer–monsoon season, heavy clay–loam soils, high yields of paddy, abundantly developed irrigation and an assured market similar to that for wheat have largely encouraged the farmers to select and raise this crop on a large part of their farmland. In the prevailing physico-economic situation, no other crop of the season equals it in monetary returns. It is the most important market crop. Nearly 95 per cent of the total paddy produce of the village is sold for cash. Sugarcane covers only 0.5 per cent of the *kharif* cropland. It is hardly sufficient to meet the domestic needs of the villagers. Less favourable environments, a lower margin of profit and the absence of a sugar–mill (market) nearby have restricted its cultivation. Sorghum ( jowar ), a fodder crop, occupies 2.5 per cent of the ercpland of the *kharif* season. Its selection has been largely guided by the heavier soils of the village, which are suitable for this crop, but are detrimental to pearl-millet ( bajra ) and clusterbean ( guara ), the other fodder crops of the season.

Vegetables (both winter and summer) are raised only on 1.5 per cent of the total cropped area of the village. The dependable tube–well irrigation is an incentive for raising these crops. However, the distance

## DECISION MAKING ON A FARM
Second Stage

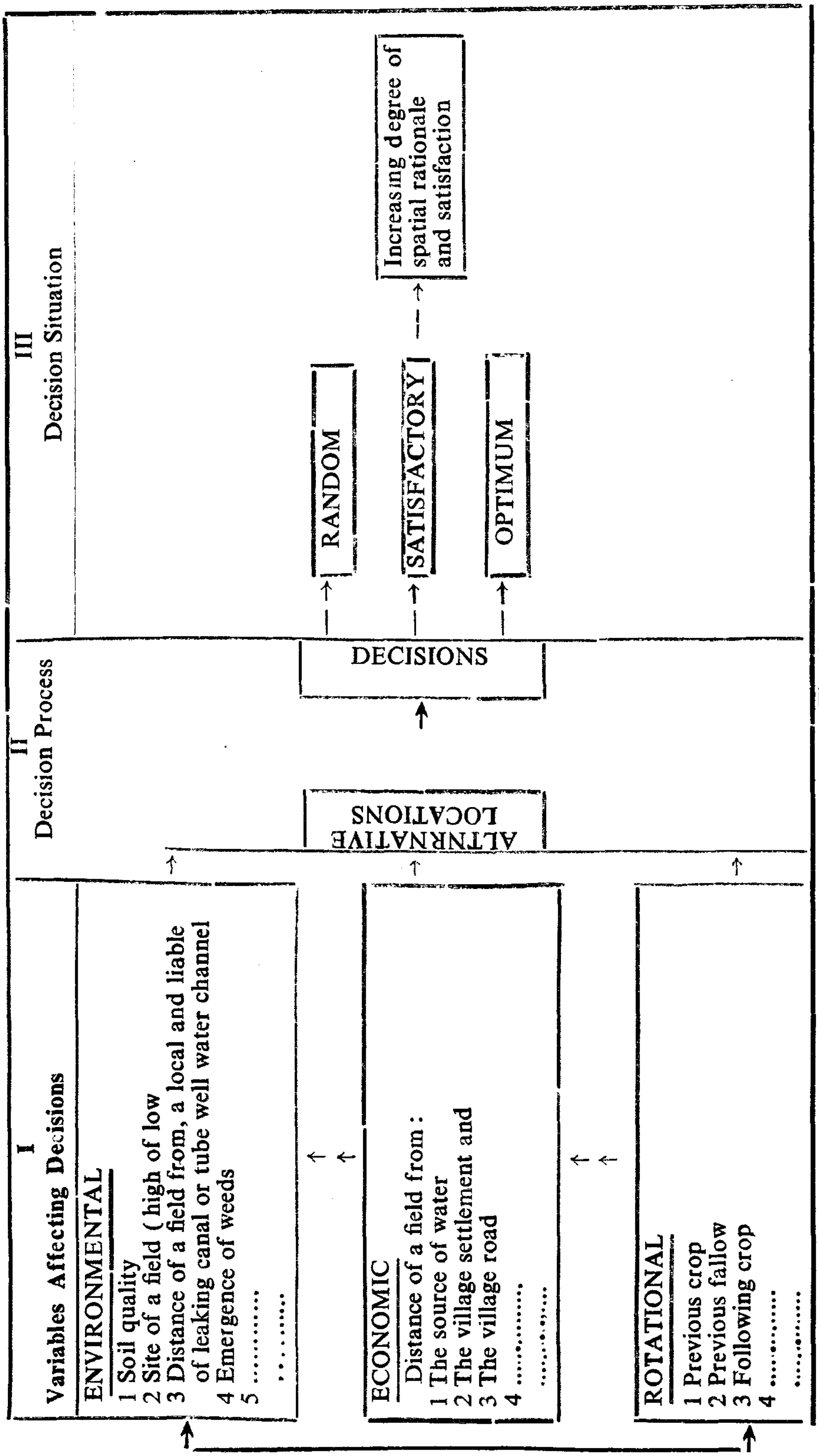


Fig. 2

from the market, heavy soils, the shortage of labonr, the lack of will and the technical skill have restrained the farmers from resorting to their cultivation on a commercial scale. This activity, thus, has remained a kitchen-garden affair.

**Decision-making and Location of a Particular Crop in a Particular Field**

After the selection of crops and the allocation of area to them, the farmer faces a problem of choosing a field for a crop. The selection of a field for a specific crop constitutes the second stage in decision-making on a farm ( Fig. 2 ).

Vegetable crops are highly specific in locational preferences. The distance from the source of water has been instrumental in choosing their field locations. Vegetable fields fall at an average distance of 35 metres from the source of water ( distances have been measured from the centre of each vegetable field to the source from where it draws water ) ( Table II ). No other crop of the village lies so close to water. Frequent and regular water needs of vegetable crops explain this fact. Each time water is taken from the source to a field for irrigation through an unlined and open waterchannel, some of it is lost through seepage, evaporation and leakage. This loss increases when a more water-demanding crop is located far from the source. Being fully aware of this economic reality, almost every farmer of the village has preferred to grow vegetables near the source of water. The distance from the settlement is another variable which guided the locational decisions of the farmers in this respect. Vegetable fields of the village are located at an average distance of 402 metres from the settlement ( distances have been measured from the centre of the settlement up to the centre of each vegetable field ). No other crop of the village is located so near to the settlement. The selection of vegetable fields near their homes by a majority of the farmers has been guided by the economics of vegetable cultivation. In case a farmer does not own land adjoining the settlement, he tends to raise them in the nearest posible field. Relatively light soils with good water and air regimes, slightly higher fields from where water can be drained easily, if need be, and the fallow fields or those from where the crops had been harvested earlier-making possible the timely sowing of vege,

**Table II**

**Locational distances of Various crops in Village Devinagar Hirasinghwala : 1979-80**

| Sr. N. | Crops | Average distance ( in metres ) from the Source of water | Village settlement | Vilage roads |
|---|---|---|---|---|
| | **Rabi** | | | |
| 1 | Vegetables | 35 | 402 | 115 |
| 2 | Clover | 62 | 504 | 107 |
| 3 | Wheat | 125 | 574 | 117 |
| 4 | Gram | 134 | 592 | 111 |
| 5 | Lentil | 148 | 628 | 153 |
| | **Kharif** | | | |
| 6 | Sorghum | 97 | 510 | 106 |
| 7 | Paddy | 113 | 542 | 107 |

tables, are the other variables which influenced the fieldswiae location of vegetables.

As in the case ol vegetables, the distance from the source of water has strongly influenced the selection of the fields for clover. This crop has been raised at 53 places in the village. The clover fields are located at an average distance of 62 metres from the source of water and, thus, come next only to vegetables. The selection of 39 clover fields has been exclusively guided by this variable.

The remaining 14 locations also fall within a manageable distance from the source of water.Clover is a ratoon crop. It needs water at least once a week during winter (November to February) and twice a week during summer(March to June).In the context of its heavy water requirements, a majority of the farmers have decided to grow clover near the source of water. The distance from the village ssttlement is another factor which played an important role in the lccational decisions of this crop. Clover fields have been located at an average distance of 504 metres from the village settlement and, thus, come next only to vegetables. This crop has to be transported daily from the fields to the settlement for feeding it to cattle. It involves heavy transport costs in terms of time and energy.For convenience, a majority of the farmers preferred to raise it near the sestlement. The distance from the village roads too affected its fieldwise locations. Clover fields lie at an average distance of 107 metres from the roads used to approach them. No other crop of the *rabi* season is located so close to the roads. The convenience of transport from roadside locations has been instrumental in this case. The control of plalaris minor ( *gulli-danda* ), a weed associated with wheat, has been the unique incentive for growing clover at six locations. During the recent years, this weed has spread menacingly. Its growth can be restricted by using certain chemicals (Tribunal, Dosanex, Tolkan, etc). However, their price, especially for small farmers, is prohibitive. Under financial constraints, some of them have decided to grow clover instead of wheat in infested fields as a remedial measure. Being a ratoon crop, clover is extracted time and again. Along with it, the weed is also cut down again and again. This practice prevents the formation and falling of its seed in tho soil thereby preventing its germination for one or two coming seasons. At sixteen locations, clover was grown in those fields which were lying either fallow or were under sorghum fodder crop. Such fields were selected because of their ready availability for timely sowing. Its fieldwise locations are also determined by the subsequent crop. In a few cases, clover has been grown in those fields which were to be put under the paddy nursery in the coming season. Being a leguminous crop, clover enriches the soil with nitrogen. The fields enriched in this way yield healthy nurseries.

Lentil and gram are winter pulses. The locational decisions with respect to these crops have been guided by the same set of factors They are sensitive to excessive soil moisture and soil salts. In the context of the heavy soil of the village, they need no irrigation. Secondly, they are less intensive and less remunerative. Thus the fields located far from the source of water or where irrigation facilities are inadequate and those falling far from the settlement have been largely preferred for growing these crops. Also the fields having a lower concentration of salts and those located at higher sites were common choice for lentil and gram. Low fields or those adjoining canal or tubewell channels have been generally avoided for fear of being flooded. These crops do better if sown early ( the third or the fourth week of October ). That is why fallow fields or those under sorghum during the previous season have been largely selected for them, Linseed is tolerant of more moistue and thus been preferably grown in low lying fields or where flooding is feared as a result of breaches in canals. In these respects, linseed is opposite to gram and lentil. However, it is similar to them as far as their requirement of soil, with a low salt content is concerned.

Sorghum is a major fodder crop of the *kharit* season, the monsoon rain provides enough moisture for its success. The early sown crop, however, needs one or two irrigations. Thus ths distance from a source of water did not influcce its location to any notable extent. As in the case of clover, the distances from the village settlement and from the village roads have been the major factors in choosing fields for this crop.

Wheat and paddy are raised in all parts of the village. They stretch from the village settlement to the periphery, from village roads to the interior locaions and from the source of water to distant fields. A greater range of environmental tolerance and substantial coverage of area by them largely explains their ubiquity.

**Conclusions**

Spatial organization of crops on a farm is the net result of a two-phase decision-making process of a farmer. The first phase deals with the selection of crops and the allocation of area to them. The second phase relates to the selection of a field for a crop. Accordingly, a two-stage decision-making model on a farm has been proposed. The inventory of factors governing the locational decisions portrayed in the model emerged from the investigations in one village. Similar studies in some other villages of northen India may validate, refute or improve upon the model.

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