CHAPTER V

COMPONENTS OF FARM PLANNING

Three basic components broadly delimit the process of farm planning:

1) Resources available are limited;
2) there are alternative processes of activities to use these resources, and
3) there are definite quantifiable objectives to be maximized or satisfied.

If there were no restrictions to the available resources, any number of activities or their combinations could be taken up without any constraint. The problem of rationalizing the resource use arises when resources are limited and have alternative uses. The scarcity of resources is not an absolute but a relative term. A factor or resource is considered to be scarce when its supply cannot meet the demand for it. However, the scarcity of a certain factor is relative to the level of other factors too, which in combination with that particular factor make the maximum contribution to the pursuit of an activity or combination of activities.

Again, some of the farm resources may be limiting for certain enterprises for one season and may not be for the other crop season. Taking a specific case of the farm Jodhan - II, maize and cotton land, sugarcane sharif land and

1. See Resource Restrictions and Input Coefficients in Table V-3.
groundnut land, picking labour, irrigation capacity, manure and Kharif season liquid capital, though restricted in absolute supply, are not scarce resources for Rabi season activities such as wheat and gram. This is so because in Rabi season there was no demand for these resources in terms of input requirements. Similarly, in Kharif season wheat land and gram land though limited in supply in rabi were not limiting or scarce resources for Kharif season activities such as cotton, sugarcane and groundnut. Resources which are not limiting in Rabi season can, thus, become scarce in Kharif and those not scarce in Kharif might become limiting in Rabi, because of seasonal input requirements. Scarcity in the first place is, therefore, relative to demand.

Again, the scarcity of a certain resource was felt in relation to the availability of the others. Wheatland, for instance, was the most limiting factor for the production of wheat (P₁) in this area but the scarcity of other resources such as April labour, October-November labour and Kabi season cash used in the production of wheat was only relative to this most limiting factor. In case of maize growing activity (P₉), the most limiting resources were maize land and manure. Scarcity of other resources was relative to these most limiting factors.

Considering these activities together, more than one resource could turn out to be the limiting factor. The aggregate factor demand of different activities changes the pattern of the most limiting resources. In this farm situation, if 9 acres were put under wheat, it consumed 234 man hours of
October-November labour leaving only 50 hours for other activities. Thus, for the maize growing activity, it would not be the maize land or manure, but October-November labour which would be the most limiting factor.

The Indian farm resources are mainly limited in respect of:

1) Land of various categories
2) Labour in specific peak work periods
3) Irrigation facilities
4) Farm yard manure and
5) Cash.

Land use capability seemed to be the most limiting factor to farm production in the situations studied in this sample. Of the given farm acreage, some land was unsuitable, or at least considered to be so by the farmer for the cultivation of certain crops.

Labour was not a limiting factor throughout the year, but shortage was normally felt in peak work load periods. Scarcity of labour was particularly felt or apprehended during:

i) Middle of March to middle of April due to sowing of sugarcane and harvesting of gram, etc.

ii) Middle of April to end of April, due to harvest of wheat.

iii) Middle of October to middle of November because of Rabi sowings and harvest of Kharif crops, such as maize and groundnut, and

iv) Middle of November to middle of March, when crushing of sugarcane, irrigation, hoeing and weeding of Rabi crops competed for labour.

A specific limitation of picking labour was felt for cotton crop in October-November. This was a major restriction on the cultivation of cotton crop in the area.

For such crops as cotton and sugarcane which were
in growing stage in April - July period, available water resources posed a main restriction on the crops. Farm yard manure was generally applied to the Kharif crops. Certain crops like sugarcane and cotton were seldom grown without a basal dose of farm yard manure. Hence FYN was a limiting factor to many of the crop enterprises in Kharif.

Capital is one of the most limiting factors with the Indian farmer. This is the reason, credit facilities are often emphasised for efficient farming. It was observed that in respect of routine jobs and execution of day to day activities at given levels of inputs, cultivation being labour intensive, farmers did not feel so acute a shortage of funds. It was mainly when they had to purchase new implements, seed, bullocks, sink a well or effect any capital investment in farm business that shortage of funds affected their decision. It is, therefore, pertinent to keep in mind the cash limitations of the farmer while planning for optimum enterprise combination.

Pattern of various resource restrictions as obtained from the average of sample farms (synthetic farm situation) are given as under:

<table>
<thead>
<tr>
<th>Resource Limitations</th>
<th>Resource Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat Land irrigated</td>
<td>9.43 acres¹</td>
</tr>
<tr>
<td>Wheat Land unirrigated</td>
<td>2.88 &quot;</td>
</tr>
<tr>
<td>Gram Land irrigated</td>
<td>3.20 &quot;</td>
</tr>
<tr>
<td>Gram Land Unirrigated</td>
<td>2.86 &quot;</td>
</tr>
<tr>
<td>Berseem Land</td>
<td>6.50 &quot;</td>
</tr>
<tr>
<td>Rabi Fodder's Land (Other than Berseem)</td>
<td>7.60 &quot;</td>
</tr>
<tr>
<td>Sugarcane Rabi land</td>
<td>6.50 &quot;</td>
</tr>
<tr>
<td>Maize Land</td>
<td>7.12 &quot;</td>
</tr>
<tr>
<td>Sugarcane Kharif Land</td>
<td>6.50 &quot;</td>
</tr>
</tbody>
</table>

¹ Of 9.20 acres of total irrigated land 0.37 acres were reserved for kitchen garden and miscellaneous use.
Resource Limitations

<table>
<thead>
<tr>
<th>Resource Limitations</th>
<th>Resource Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundnut land irrigated</td>
<td>1.46 acres</td>
</tr>
<tr>
<td>Cotton land irrigated</td>
<td>8.66 &quot;</td>
</tr>
<tr>
<td>Groundnut land Unirrigated</td>
<td>1.61 &quot;</td>
</tr>
<tr>
<td>Kharif Fodders land</td>
<td>11.10 &quot;</td>
</tr>
<tr>
<td>Mid, March - Mid, April</td>
<td></td>
</tr>
<tr>
<td>permanent farm labour</td>
<td></td>
</tr>
<tr>
<td>Mid, April - End April</td>
<td></td>
</tr>
<tr>
<td>permanent farm labour</td>
<td></td>
</tr>
<tr>
<td>Mid, October - Mid, November</td>
<td></td>
</tr>
<tr>
<td>permanent farm labour</td>
<td></td>
</tr>
<tr>
<td>Mid, November - Mid, March</td>
<td></td>
</tr>
<tr>
<td>permanent farm labour</td>
<td></td>
</tr>
<tr>
<td>Picking labour maximum</td>
<td>3.6 acres</td>
</tr>
<tr>
<td>Irrigation maximum during April-July</td>
<td>5.36 &quot;</td>
</tr>
<tr>
<td>Farm yard manure</td>
<td>56 tons</td>
</tr>
<tr>
<td>Kharif Season Cash (Rupees)</td>
<td>289.00</td>
</tr>
<tr>
<td>Rabi Season cash (Rupees)</td>
<td>250.00</td>
</tr>
</tbody>
</table>

Physical limitations were not the only resource restrictions affecting decision making process of the farmers. Sometimes, mental reservations of the farmer placed drastic restrictions on his resources. While planning with the farmers, his willingness to execute a certain programme was a prerequisite to the successful implementation of the plan. The farmer did not, sometimes, want to go beyond a certain level with certain enterprises. Gram, for example, was not grown over a major portion of the land in this area which might be otherwise suitable for the crop.

Often, it was difficult for an ordinary cultivator to assess his resource restrictions correctly while making decisions about the enterprise combinations for his farm. It was, thus, quite rewarding if inventory of limited resources was carefully recorded before proceeding to decide upon a realistic and optimum enterprise combination.

The objective of the farm planning process is to maximize the returns to the fixed farm resources through a
rationalized use of the limited farm resources. To rational
resource use can be effected through an optimum combination
of the alternative farm enterprises. Farmers in the study
area rated the alternatives in terms of crop enterprises only.
It was rare that any regular planning of commercial animals
or poultry enterprises was considered along side the crop
enterprises. Among the crops, however, there was a sufficient
choice not only between different crops but also between
levels of the alternative activities. It may be emphasized
that a crop activity was not just one activity but several
activities due to difference in soil, irrigation facilities
and the rotations in which these figured. Thus, with a
view to maximizing the objective function \( Z = p_1 + p_2 \ldots \)
\( \ldots + p_n \)\(^1\) the farm entrepreneur had to decide upon optimal
combination of alternative farm enterprises. This involves
techniques of farm planning. Budgeting and linear programming
techniques of farm management analysis are widely used to
maximize this objective function.

**Budgeting**

Budgeting and farm planning are generally treated
as collateral terms but technically farm planning must precede
budgeting analysis. "In brief, the technique begins with the
elaboration of the rudiments of a given farm plan or portion
thereof."\(^2\) Based on the budgeting analysis of the alternative

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1. \( Z \) indicates returns to the fixed farm resources and \( p_1 + p_2 \ldots \)
\( \ldots + p_n \) indicate combination of various activities.
farm plans, the alternative plans are developed until the returns to the limited farm resources are maximized. Thus, "Primary purpose of planning and budgeting for individual farmer, therefore, is to improve the organisation and operations of their farms." The budgeting process has a scope for dealing with the organisation of a particular activity or the organisation of the farm business as a whole. In case it deals with one or a few activities only, it is known as partial budgeting. It may be desired for example to estimate additional costs and returns from growing one acre of Hybrid Maize in place of local maize. Here additional costs due to seed, manure, irrigation, etc., need to be estimated and compared with additional expected returns. In case, the budgeting analysis involved complete re-organisation of the farm business, it was known as complete budgeting. This envisaged a thorough reshuffle and a new combination of farm enterprises might be arrived at.

Procedure

In developing an optimum farm plan with the budgeting technique, the following steps are generally followed:

1) Map of the farm is drawn depicting all the soil types and topographical features.

2) Inventory of resources on the farm in respect of land, labour, animals, buildings, machinery and liquid capital (cash) is taken. This helps assessment of resource limitations and production capabilities of the farm. To these resources, possibilities of hiring or borrowing are added. These restrictions lay down a framework within which a farm plan is considered.

iii) Present plan followed by the cultivators is analysed for its costs and returns and resource use pattern.

iv) Weaknesses in the present plan are located.

v) In view of these weaknesses, new plans are developed within the framework of resource restrictions.

vi) New plans are analysed for cost and returns and the optimum plan which promises the highest returns, is selected.

These procedural steps presuppose that the input-output data for various enterprises were available from records or research publications. This information was, however, lacking in respect of this study area as is generally the case with most of the unexplored areas. Reliance had, therefore, to be placed on personal survey of the area and conference with the cultivators. Sufficiently reliable data on yields, various items of costs and farm operations, etc., were obtained in conference with the cultivator and these data were rationalised with the help of the agricultural experts.

As an illustration of the various procedural steps in the process of farm planning, 'Jodhan -II' farm was planned and budgeted as under:

1) Maps: An outline of the location of different fields, wells and irrigation channels, approach roads, etc., was prepared as shown in the map of holding.

ii) Inventory of limited resources: The limited and fixed farm resources were classified as under:

<table>
<thead>
<tr>
<th></th>
<th>Irrigated</th>
<th>Unirrigated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owned</td>
<td>7.05 acres</td>
<td></td>
</tr>
<tr>
<td>Rented in</td>
<td>4.60 acres</td>
<td>3.60 acres</td>
</tr>
<tr>
<td>Total</td>
<td>11.65</td>
<td>2.60</td>
</tr>
</tbody>
</table>

A. Land
### Classification of Land

<table>
<thead>
<tr>
<th>Crop</th>
<th>Land fit for the crop</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabi season:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat irrigated</td>
<td>11.50 acres 0.15 acres were kept for kitchen garden.</td>
<td></td>
</tr>
<tr>
<td>Wheat Unirrigated</td>
<td>2.60</td>
<td></td>
</tr>
<tr>
<td>Gram irrigated</td>
<td>3.50</td>
<td>Rest of the land was heavy soil and wheat was preferred there.</td>
</tr>
<tr>
<td>Gram unirrigated</td>
<td>2.50</td>
<td></td>
</tr>
<tr>
<td>Sugarcane</td>
<td>5.60</td>
<td>Remaining land was not favored for these crops due to difficult water approach.</td>
</tr>
<tr>
<td>Fodders</td>
<td>5.50</td>
<td></td>
</tr>
<tr>
<td>Kharif season:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize &amp; Cotton</td>
<td>7.50</td>
<td>Remaining land was not considered to be fertile for these crops.</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>5.50</td>
<td></td>
</tr>
<tr>
<td>Gramnuts:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>irrigated</td>
<td>2.00</td>
<td>Only this much land had proper sandy soil depth.</td>
</tr>
<tr>
<td>unirrigated</td>
<td>2.50</td>
<td></td>
</tr>
<tr>
<td>Fodders</td>
<td>10.00</td>
<td></td>
</tr>
</tbody>
</table>

These land categories, according to use capabilities, were not mutually exclusive. One crop enterprise affected the land availability for the other enterprises.

### B. Permanant Farm Labour

<table>
<thead>
<tr>
<th></th>
<th>Persons</th>
<th>Man hours per person per day</th>
<th>Total man hours available per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family labour</td>
<td>1</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Hired labour</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Total 10

### C. Farm Animals

<table>
<thead>
<tr>
<th>Draft Animals</th>
<th>Number</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bullocks</td>
<td>2</td>
<td>Good</td>
</tr>
<tr>
<td>Camels</td>
<td>1</td>
<td>Good</td>
</tr>
</tbody>
</table>
**Other Animals:**
- Buffaloes 2
- Buffalo calves 2

**D. Farm Buildings**
- One shed for animals = 18′ x 30′
- One room for fodder & implements etc. = 12′ x 12′

**E. Irrigation Capacity**

<table>
<thead>
<tr>
<th>Source</th>
<th>Capacity per week from March to Mid. July.</th>
</tr>
</thead>
<tbody>
<tr>
<td>One well - 1/4th share</td>
<td>1.00 acre</td>
</tr>
<tr>
<td>One well - 1/3rd &quot;</td>
<td>1.75 acres</td>
</tr>
<tr>
<td>Canal (8 hours turn)</td>
<td>1.75 acres</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4.50 acres</td>
</tr>
</tbody>
</table>

**F. Picking Labour:**

It was not possible to get picking labour for more than 3 acres of cotton. So, 3 acres restriction was placed on growing this crop.

**G. Farm Yard Manure**

- Owned 20 tons
- Purchased 40 "

**Total: 60 "

**H. Cash**

<table>
<thead>
<tr>
<th>Season</th>
<th>Owned</th>
<th>Borrowed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kharif</td>
<td>300.00</td>
<td>100.00</td>
<td>400.00</td>
</tr>
<tr>
<td>Rabi</td>
<td>176.00</td>
<td>76.00</td>
<td>252.00</td>
</tr>
</tbody>
</table>

Such resource limitations need to be examined carefully. Otherwise successful implementation of the plans would be difficult.

In order to know the returns to the fixed farm resources from various crop activities, variable costs such as hired labour, seed, water charges, fertilizers, insecticides, etc., were deducted from the gross returns. With the help of these net returns to the fixed farm resources from various
crop enterprises, the total net return to the fixed farm resources from the existing plan of the farmer was analysed as follows:

### iii) Existing Farm Plan

<table>
<thead>
<tr>
<th>Crop enterprise</th>
<th>Acreage</th>
<th>per acre</th>
<th>£/acre</th>
<th>Total return to fixed resources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rabi Season:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat irrigated after fallow</td>
<td>2.50</td>
<td>229.00</td>
<td>572.50</td>
<td></td>
</tr>
<tr>
<td>Wheat irrigated after Kharif</td>
<td>2.71</td>
<td>186.00</td>
<td>504.06</td>
<td></td>
</tr>
<tr>
<td>Gram irrigated</td>
<td>1.46</td>
<td>137.00</td>
<td>200.00</td>
<td></td>
</tr>
<tr>
<td>Gram unirrigated</td>
<td>2.50</td>
<td>121.00</td>
<td>302.50</td>
<td></td>
</tr>
<tr>
<td><strong>Fodder</strong></td>
<td>2.50</td>
<td></td>
<td></td>
<td>(consumed by farm livestock)</td>
</tr>
<tr>
<td><strong>Kharif Season:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize after fallow</td>
<td>1.50</td>
<td>244.00</td>
<td>366.00</td>
<td></td>
</tr>
<tr>
<td>Maize after wheat</td>
<td>1.00</td>
<td>189.00</td>
<td>189.00</td>
<td></td>
</tr>
<tr>
<td>Desi cotton</td>
<td>0.63</td>
<td>253.00</td>
<td>159.39</td>
<td></td>
</tr>
<tr>
<td>Sugarcane</td>
<td>0.83</td>
<td>574.00</td>
<td>470.42</td>
<td></td>
</tr>
<tr>
<td>Groundnut irrigitated</td>
<td>1.04</td>
<td>241.00</td>
<td>250.64</td>
<td></td>
</tr>
<tr>
<td><strong>Fodders</strong></td>
<td>3.50</td>
<td>(consumed by farm livestock)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Net Returns to the Fixed Farm Resources:** 3020.53

### iv) Weaknesses in the Plan

An analysis of the resource use in the existing plan was made in Table V-1. The analyses showed an imbalance and low level of resource use. Improvement in the existing

1. The net returns to the fixed farm resources are shown in Table V-2.
plan was, therefore, possible by:

a) replacing Desi cotton by American cotton, because of better returns to the latter without any major shift in resource use,

b) increasing acreage under groundnut, especially unirrigated because of high returns and low input level,

c) increasing acreage under labour intensive and high revenue yielding crops like sugarcane, because of abundant labour available on the farm,

d) decreasing fallow acreage both in Rabi and Kharif, and

e) increased utilization of irrigation facilities, farm yard manure and Kharif season cash available to the farm.

It was apparent that Kharif plan showed greater promise for improvement than the Rabi plan because of excess of irrigation facilities, farm yard manure and seasonal cash.

v) Alternative Plans

Within the framework of resource restrictions (Table V-1), alternative farm plans were developed along two directions:

i - main emphasis was placed on cotton (American) in Kharif and wheat in Rabi season. Sugarcane acreage was kept at a comparatively low level and was meant mainly to meet the house hold requirements, and

ii - Sugarcane acreage was increased. As a result cotton and wheat acreage had to be kept low.

The two plans were built as under:

1. Farm planning in this section had been attempted on the basis of given production techniques of the farmer. No improved technique or innovation was considered.
<table>
<thead>
<tr>
<th>Crop Enterprises</th>
<th>Plan I</th>
<th>Plan II</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rabi Season:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat irrigated after Kharif</td>
<td>6.75 acres</td>
<td>3.5 acres</td>
</tr>
<tr>
<td>Gram irrigated</td>
<td>2.50&quot;</td>
<td>2.50&quot;</td>
</tr>
<tr>
<td>Gram unirrigated</td>
<td>1.10&quot;</td>
<td>1.75&quot;</td>
</tr>
<tr>
<td>Fodders</td>
<td>2.50&quot;</td>
<td>2.50&quot;</td>
</tr>
<tr>
<td><strong>Kharif Season:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>1.50&quot;</td>
<td>1.00&quot;</td>
</tr>
<tr>
<td>American cotton</td>
<td>2.50&quot;</td>
<td>1.00&quot;</td>
</tr>
<tr>
<td>Desi cotton</td>
<td>0.50&quot;</td>
<td>0.50&quot;</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>0.50&quot;</td>
<td>2.50&quot;</td>
</tr>
<tr>
<td>Groundnut irrigated</td>
<td>-</td>
<td>1.00&quot;</td>
</tr>
<tr>
<td>Groundnut unirrigated</td>
<td>1.50&quot;</td>
<td>1.00&quot;</td>
</tr>
<tr>
<td>Fodders</td>
<td>3.50&quot;</td>
<td>3.50&quot;</td>
</tr>
</tbody>
</table>

These plans reduced acreage under fallow land and made rational use of the limited resources was made in respect of land, labour and capital.

**vi) Analysis of Returns**

Analysis of the returns to the fixed farm resources from the various commercial crop enterprises of the two plans was made as under:

<table>
<thead>
<tr>
<th>Crop Enterprises</th>
<th>Plan I</th>
<th>Plan II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acre- Returns</td>
<td>Total Acre- Returns</td>
</tr>
<tr>
<td></td>
<td>(acres)</td>
<td>per acre returns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Rs.)</td>
</tr>
<tr>
<td><strong>Rabi Season:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat irri.</td>
<td>6.75</td>
<td>186.00</td>
</tr>
<tr>
<td>Gram irri.</td>
<td>1.10</td>
<td>137.00</td>
</tr>
<tr>
<td>Gram Unirri.</td>
<td>2.50</td>
<td>121.00</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td>1720.50</td>
<td>214.00</td>
</tr>
<tr>
<td><strong>Kharif Season:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>1.50</td>
<td>189.00</td>
</tr>
<tr>
<td>American cotton</td>
<td>2.50</td>
<td>231.00</td>
</tr>
<tr>
<td>Desi cotton</td>
<td>0.50</td>
<td>253.00</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>0.50</td>
<td>574.00</td>
</tr>
<tr>
<td>Groundnut irri.</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Groundnut unirri.</td>
<td>1.50</td>
<td>214.00</td>
</tr>
<tr>
<td><strong>Totals:</strong></td>
<td>1720.50</td>
<td>214.00</td>
</tr>
</tbody>
</table>

Total Net Returns to the Fixed Farm Resources 3429.80 3679.75

Plan I gave comparatively higher returns in Rabi season due to larger acreage under wheat crop. Plan II promised
higher returns in Kharif season. Over the year as a whole, the analysis showed that the Plan II was better in maximizing the returns to the fixed farm resources. The higher returns over the existing Plan were made possible because of increased acreage under Sugarcane and Groundnut. Wheat and Maize acreage decreased instead.

In the budgeting process, a research worker or a farm planner has to rely on his personal judgement and the approach is more of a subjective and intuitional nature. Also, the budgeting process is not so stream-lined as to give a unique optimum farm plan out of multiple alternatives under a given framework of resource restrictions. Its effective use is, therefore, generally limited to choice-making from among a limited number of enterprises. When the choice is to be made among many alternatives and resource limitations are larger in number, linear programming is a better suited technique.

Linear Programming

Linear Programming is an important mathematical technique of farm management analysis. In fact, "Linear Programming constitutes the major tool in a broad field of empirical method known as activity analysis. Linear Programming generally refers to the computational method used in prescribing production patterns which maximize profits of firms, minimize cost of producing a specific commodity or related types of aggregation analysis."  

1. Earl O. Heady and Wilfred Candler, Linear Programming Methods, Iowa State University Press, Ames, Iowa, 1960, p.4
Actually, both budgeting and linear programming techniques are based on the same assumption and require the same input-output data. They need the same delimitation of resource restrictions. Accuracy of input-output coefficients need the same emphasis in one as in case of the other. The difference lies in the process of analysis only.

As an illustration, application of linear Programming was made to the same farm situation (Jolba - II). In this process, the variable costs for different commercial crop enterprises were worked out as under:

<table>
<thead>
<tr>
<th></th>
<th>Irrigated After</th>
<th>Irrigated Kharif</th>
<th>Unirrigated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoeing @ £ 2.50 per man day</td>
<td>10.00</td>
<td>10.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Chaffing @ £ 16.00 per 100 bundles of one maund each</td>
<td>11.20</td>
<td>8.80</td>
<td>7.20</td>
</tr>
<tr>
<td>Seed @ £ 16.00 per maund</td>
<td>12.00</td>
<td>12.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Water charges @ 3.21 per maund</td>
<td>3.21</td>
<td>3.21</td>
<td>-</td>
</tr>
<tr>
<td>Misc.expenses @ 5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>41.41</strong></td>
<td><strong>39.01</strong></td>
<td><strong>27.20</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Irrigated</th>
<th>Unirrigated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoeing @ £ 2.50 per man day</td>
<td>5.00</td>
<td>-</td>
</tr>
<tr>
<td>Seed @ £ 15.00 per md.</td>
<td>6.00</td>
<td>6.00</td>
</tr>
<tr>
<td>Water charges</td>
<td>3.01</td>
<td>-</td>
</tr>
<tr>
<td>Misc.expenses</td>
<td>5.00</td>
<td>3.00</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>19.01</strong></td>
<td><strong>11.01</strong></td>
</tr>
</tbody>
</table>

1. Variable costs were worked out on the basis of pattern of farm operations (Appendix VI) and items of variable costs (Appendix VII).

2. Only two third of the cropped acreage other than herseem got canal water. Two third of the water charges were, therefore, included in the variable costs.
**1. Since the crop was raised with well irrigation, the farmer did not pay irrigation charges for this crop.**

### Areca

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed @ Rs. 4.00 per seer</td>
<td>40.00</td>
</tr>
<tr>
<td>Misc. expenses</td>
<td>5.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>45.00</strong></td>
</tr>
</tbody>
</table>

### Senji

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed @ Rs. 20.00 per mi.</td>
<td>8.00</td>
</tr>
<tr>
<td>Water charges</td>
<td>2.50</td>
</tr>
<tr>
<td>Misc. expenses</td>
<td>6.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16.50</strong></td>
</tr>
</tbody>
</table>

### Mothai

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed @ Rs. 20.00 per mi.</td>
<td>8.00</td>
</tr>
<tr>
<td>Water charges</td>
<td>2.50</td>
</tr>
<tr>
<td>Misc. expenses</td>
<td>6.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16.50</strong></td>
</tr>
</tbody>
</table>

### Maize

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoeing &amp; Weeding</td>
<td>7.50</td>
</tr>
<tr>
<td>Seed @ Rs. 10.00 per mi.</td>
<td>3.37</td>
</tr>
<tr>
<td>Water charges</td>
<td>4.36</td>
</tr>
<tr>
<td>Misc. expenses</td>
<td>5.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>20.23</strong></td>
</tr>
</tbody>
</table>

### Cotton

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoeing &amp; Weeding</td>
<td>7.35</td>
</tr>
<tr>
<td>Seed @ Rs. 18.00 per mi.</td>
<td>2.25</td>
</tr>
<tr>
<td>Water charges</td>
<td>4.48</td>
</tr>
<tr>
<td>Misc. expenses</td>
<td>6.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>18.13</strong></td>
</tr>
</tbody>
</table>

### Sugarcane

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoeing &amp; Weeding</td>
<td>15.00</td>
</tr>
<tr>
<td>Extralabour</td>
<td>10.00</td>
</tr>
<tr>
<td>Misc. labour</td>
<td>10.00</td>
</tr>
<tr>
<td>Water charges</td>
<td>11.00</td>
</tr>
<tr>
<td>Other unforeseen expenses</td>
<td>20.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>66.00</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoeing &amp; Weeding</td>
<td>15.00</td>
</tr>
<tr>
<td>Water charges</td>
<td>11.00</td>
</tr>
<tr>
<td>Other unforeseen expenses</td>
<td>11.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>37.00</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoeing &amp; Weeding</td>
<td>15.00</td>
</tr>
<tr>
<td>Water charges</td>
<td>11.00</td>
</tr>
<tr>
<td>Other unforeseen expenses</td>
<td>11.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>37.00</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoeing &amp; Weeding</td>
<td>15.00</td>
</tr>
<tr>
<td>Water charges</td>
<td>11.00</td>
</tr>
<tr>
<td>Other unforeseen expenses</td>
<td>11.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>37.00</strong></td>
</tr>
</tbody>
</table>

The total cost over 4 years is Rs. 288.00, 46.00, 46.00, and 46.00, respectively. The total cost over 1 year is Rs. 97.75.
Groundnut:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Irrigated</th>
<th>Unirrigated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoeing &amp; Weeding</td>
<td>£ 10.00</td>
<td>£ 10.00</td>
</tr>
<tr>
<td>Seed £ 1.00 per seed</td>
<td>£ 24.00</td>
<td>£ 20.00</td>
</tr>
<tr>
<td>Harvest labour £ 2.60 per M.day</td>
<td>£ 30.00</td>
<td>£ 15.00</td>
</tr>
<tr>
<td>Water charges</td>
<td>£ 3.36</td>
<td></td>
</tr>
<tr>
<td>Misc. Expenses</td>
<td>£ 10.00</td>
<td>£ 5.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>£ 57.36</strong></td>
<td><strong>£ 30.00</strong></td>
</tr>
</tbody>
</table>

Kharif Fodders:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed</td>
<td>£ 10.00</td>
</tr>
<tr>
<td>Water charges</td>
<td>£ 3.36</td>
</tr>
<tr>
<td>Misc. Expenses</td>
<td>£ 5.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>£ 15.20</strong></td>
</tr>
</tbody>
</table>

For bullocks and other farm animals some fodder acreage had to be reserved. This fodder acreage was treated as a fixed activity and resources required to produce 2.5 acres of Rabi fodder and 3.5 acres of Kharif fodders were, therefore, deducted from the farm resource inventories. Similarly, the inputs for miscellaneous uses other than the commercial crop enterprises were also deducted from the available resources and the net availability for commercial crops was obtained as under:

### A. Land

<table>
<thead>
<tr>
<th>Crop</th>
<th>Total Acreage</th>
<th>Reserved for Fodders</th>
<th>Not available for Commercial Crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat land irrigated</td>
<td>11.50</td>
<td>2.50</td>
<td>9.00</td>
</tr>
<tr>
<td>Wheat and gram land Unirri.</td>
<td>2.50</td>
<td>-</td>
<td>2.50</td>
</tr>
<tr>
<td>Gram land irrigated</td>
<td>3.50</td>
<td>-</td>
<td>3.50</td>
</tr>
<tr>
<td>Sugarcane Rabi land</td>
<td>5.50</td>
<td>2.50</td>
<td>3.00</td>
</tr>
<tr>
<td>Maize &amp; Cotton land</td>
<td>7.50</td>
<td>1.50</td>
<td>6.00</td>
</tr>
<tr>
<td>Sugarcane Kharif land</td>
<td>5.50</td>
<td>1.50</td>
<td>4.00</td>
</tr>
<tr>
<td>Groundnut land irrigated</td>
<td>2.50</td>
<td>-</td>
<td>2.50</td>
</tr>
<tr>
<td>Groundnut land unirrigated</td>
<td>2.00</td>
<td>-</td>
<td>2.00</td>
</tr>
</tbody>
</table>

Of the 2.5 acres of Rabi fodders, 1.00 acre of Berseem and 1.50 acres of Senji and Metha were planned to be grown. Of the 3.5 acres Kharif fodders, 1.5 acres were
intended to be grown on land categories suited to maize, cotton and sugarcane. The remaining two acres were to be planted in land not included in any of the Sharif land categories.

B. Permanent Farm Labour

<table>
<thead>
<tr>
<th>Total Availability Needed for</th>
<th>Todd- Misc. Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days M.H. Total cattle care per man</td>
<td>Days M.H. Total irrigation for comm. crops</td>
</tr>
<tr>
<td>day hours</td>
<td>per man</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mid-March-Mid April (M. Hours)</th>
<th>30</th>
<th>16</th>
<th>480</th>
<th>30</th>
<th>4</th>
<th>120</th>
<th>24</th>
<th>20</th>
<th>326</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-April-End April (M. Hours)</td>
<td>16</td>
<td>16</td>
<td>256</td>
<td>16</td>
<td>4</td>
<td>64</td>
<td>16</td>
<td>10</td>
<td>166</td>
</tr>
<tr>
<td>Mid-October-Mid Nov. (M. Hours)</td>
<td>32</td>
<td>16</td>
<td>512</td>
<td>32</td>
<td>6</td>
<td>192</td>
<td>16</td>
<td>15</td>
<td>289</td>
</tr>
<tr>
<td>Mid-Nov.-Mid March (M. Hours)</td>
<td>120</td>
<td>16</td>
<td>1,920</td>
<td>120</td>
<td>6</td>
<td>720</td>
<td>144</td>
<td>60</td>
<td>996</td>
</tr>
</tbody>
</table>

C. Picking Labour capacity

Cotton maximum = 3 acres

D. Irrigation Capacity (April-July)

Total acreage that can be irrigated per week. = 4.5 acres

Fodder acreage that needed irrigation during the period = 1.00

Net irrigation capacity for commercial crops = 3.50

E. Farm Yard Manure

<table>
<thead>
<tr>
<th>Owned</th>
<th>Purchased</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 tons</td>
<td>40 tons</td>
</tr>
</tbody>
</table>

Total availability = 60 tons

I. For cattle care in March-April, only 3 men-day was spent due to urgency of work. But, in October-November through March, due to liberal feeding, more time was spent for the purpose.
No farm yard manure would be applied to any of the Rabi crops, or Dodders. Berseem would be sown in cotton or maize fields.

F. Working Capital

<table>
<thead>
<tr>
<th></th>
<th>Total availability</th>
<th>Requirements of Dodders etc.</th>
<th>Net availability for Comm. crops</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rs.</td>
<td>Rs.</td>
<td>Rs.</td>
</tr>
<tr>
<td>Charitable season</td>
<td>300.00</td>
<td>0.00</td>
<td>240.00</td>
</tr>
<tr>
<td>Rabi season</td>
<td>250.00</td>
<td>0.00</td>
<td>200.00</td>
</tr>
</tbody>
</table>

Input of fixed farm resources

The input coefficients of various fixed farm resources for different crop activities were obtained as under:

**Wheat**

<table>
<thead>
<tr>
<th></th>
<th>Irrigated</th>
<th>Unirrigated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ted</td>
<td>Ted</td>
</tr>
<tr>
<td></td>
<td>Fallow</td>
<td>Fall</td>
</tr>
<tr>
<td>Land:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crop occupies one acre from land categories...</td>
<td>1 &amp; 3</td>
<td>1</td>
</tr>
<tr>
<td>Labour (Men hours):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid. April - End April</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Mid. Oct. - Mid. Nov.</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Mid. Nov. - Mid. March</td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td>Cash in Rabi season (Rs.)</td>
<td>18</td>
<td>10</td>
</tr>
</tbody>
</table>

**Gram**

<table>
<thead>
<tr>
<th></th>
<th>Irrigated</th>
<th>Unirrigated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ted</td>
<td>Ted</td>
</tr>
<tr>
<td></td>
<td>Fallow</td>
<td>Fall</td>
</tr>
<tr>
<td>Land:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crop occupies one acre from land categories...</td>
<td>1 &amp; 3</td>
<td>2</td>
</tr>
<tr>
<td>Labour (Men hours):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid. March - Mid. April</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Mid. Nov. to Mid. March</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Cash in Rabi season (Rs.)</td>
<td>18.00</td>
<td>5.00</td>
</tr>
</tbody>
</table>

1. see Input-output Matrix = Table V - 2.
**Maize**

<table>
<thead>
<tr>
<th>Land:</th>
<th>After fallow</th>
<th>After wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop occupies one acre from land categories ...</td>
<td>6 &amp; 1</td>
<td>5</td>
</tr>
</tbody>
</table>

**Labour (Man hours):**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid. October - Mid November</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

**Farm Yard Manure (Tons):**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>10</td>
</tr>
</tbody>
</table>

**Cash in Kharif Season (Rs.):**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>17.00</td>
<td>17.00</td>
</tr>
</tbody>
</table>

---

**Cotton**

<table>
<thead>
<tr>
<th>American Cotton</th>
<th>Deol Cotton</th>
</tr>
</thead>
<tbody>
<tr>
<td>After fallow</td>
<td>After wheat</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Land:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop occupies one acre from land categories ...</td>
<td>5 &amp; 1</td>
<td>5</td>
</tr>
</tbody>
</table>

**Labour (Man Hours):**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid. March - Mid April</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Mid April - 2nd April</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

**Picking Labour (acres):**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Irrigation (acres):**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Farm Yard Manure (tons):**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>12</td>
</tr>
</tbody>
</table>

**Working capital (Rs.):**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>22.00</td>
<td>22.00</td>
</tr>
</tbody>
</table>

---

**Sugar cane**

<table>
<thead>
<tr>
<th>Land:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The crop occupies one acre from land categories ...</td>
<td>1, 4, 5 &amp; 6</td>
<td></td>
</tr>
</tbody>
</table>

**Labour (Man hours):**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid. March - Mid April</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Mid. April - End April</td>
<td>16</td>
<td></td>
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<tr>
<td>Mid. October-Mid Nov.,</td>
<td>16</td>
<td></td>
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<tr>
<td>Mid. Nov. - 1st March</td>
<td>320</td>
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</tbody>
</table>

**Irrigation (acres):**

<p>| | |</p>
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</table>

**Farm Yard Manure (tons):**

<p>| | |</p>
<table>
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<tr>
<td>12</td>
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**Working Capital:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Kharif Season (M.):</td>
<td>33.00</td>
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</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Rabi Season (M.):</td>
<td>33.00</td>
</tr>
</tbody>
</table>
Irrigated Un irrigated
Land
- The crop occupies one acre from land categories...
- Labour (man hours):
  - Mid.Nov. - Mid.March: 0
- Working Capital (Rs.): 62.00

Net returns to the fixed farm resources from various crop enterprises are shown in Table V-2.

The following model was built up for linear programming analysis:

\[
\begin{align*}
B_1 & \leq \sum_{j=1}^{k} b_{1j} x_j \\
B_2 & \leq \sum_{j=1}^{k} b_{2j} x_j \\
& \quad \vdots \\
B_i & \leq \sum_{j=1}^{k} b_{ij} x_j \\
& \quad \vdots \\
B_n & \leq \sum_{j=1}^{k} b_{nj} x_j
\end{align*}
\]

Here: 'B' represents resource level, 'x_j' activity level of 'x_1, x_2 \ldots x_k' activities and 'b_{ij}' represents input coefficients of 'x_j' activity.

Based on this model, the problem matrix was set up in Table V-3. Application of simplex method gave the following results in the final iteration (Table V-4).
Table V - 2

Returns to Fixed Farm Resources, Farm situation Jodhpur-II, Existing Techniques, 1961-62

<table>
<thead>
<tr>
<th>Crop</th>
<th>Gross Income</th>
<th></th>
<th>Variable Costs</th>
<th>Returns to fixed farm resources</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yield</td>
<td>Price per acre</td>
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<td></td>
<td>Fds.</td>
<td>E.</td>
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<td>E.</td>
</tr>
<tr>
<td>Wheat after fallow irrigated</td>
<td>18</td>
<td>15.00</td>
<td>270.00</td>
<td>41.41</td>
</tr>
<tr>
<td>Wheat after Kharif irrigated</td>
<td>16</td>
<td>15.00</td>
<td>226.00</td>
<td>39.01</td>
</tr>
<tr>
<td>Wheat unirrigated</td>
<td>12</td>
<td>15.00</td>
<td>120.00</td>
<td>27.0</td>
</tr>
<tr>
<td>Gram irrigated</td>
<td>13</td>
<td>12.00</td>
<td>156.00</td>
<td>19.01</td>
</tr>
<tr>
<td>Gram Unirrigited</td>
<td>11</td>
<td>12.00</td>
<td>132.00</td>
<td>11.00</td>
</tr>
<tr>
<td>Maize after fallow</td>
<td>24</td>
<td>11.00</td>
<td>264.00</td>
<td>20.23</td>
</tr>
<tr>
<td>Maize after wheat</td>
<td>19</td>
<td>11.00</td>
<td>209.00</td>
<td>20.23</td>
</tr>
<tr>
<td>Cotton after wheat</td>
<td>7.5</td>
<td>40.00</td>
<td>300.00</td>
<td>19.3</td>
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<tr>
<td>Cotton after fallow</td>
<td>10</td>
<td>40.00</td>
<td>400.00</td>
<td>19.23</td>
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<tr>
<td>Desi cotton</td>
<td>9</td>
<td>30.00</td>
<td>270.00</td>
<td>16.73</td>
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<tr>
<td>Sugarcane</td>
<td>48</td>
<td>14.00</td>
<td>672.00</td>
<td>97.75</td>
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<tr>
<td>Groundnut irrigated</td>
<td>14</td>
<td>22.00</td>
<td>308.00</td>
<td>67.37</td>
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<tr>
<td>Groundnut Unirrigated</td>
<td>12</td>
<td>22.00</td>
<td>264.00</td>
<td>50.00</td>
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**NOTES:** The entries are net returns to the fixed farm resources in rupees.

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**Notes:**
- In the case of crop resources, the entries are net returns to the fixed farm resources in rupees.
- The table represents the net returns to different combinations of inputs and resources.
Crop Enterprise | Acreage | Net returns per acre to the fixed farm resources | Total net returns to the fixed farm resources
--- | --- | --- | ---
Rabi Season:
Wheat after Kharif irrigated ($P_1$) | 2.66 | 186.90 | 494.76
Wheat after fallow irrigated ($P_2$) | 0.31 | 229.00 | 70.99
Wheat unirrigated ($P_3$) | 0.60 | 152.00 | 91.80
Gram irrigated ($P_4$) | 3.50 | 137.00 | 479.60
Gram unirrigated ($P_5$) | 1.90 | 121.00 | 229.00
Fodders (fixed activity) 2.00 | | | Total: 1339.75
Kharif Season:
Maize after Rabi ($P_6$) | 2.19 | 169.00 | 413.91
Desi cotton ($P_{10}$) | 0.87 | 222.00 | 245.41
Sugarcane ($P_{11}$) | 2.63 | 574.00 | 1462.22
Groundnut unirri. ($P_{13}$) | 2.25 | 211.00 | 431.50
Fodders (fixed activity) 3.50 | | | Total: 2259.05
Total Net Returns to the fixed farm resources: 3592.99

This plan was an improvement over the budgeted farm plan inasmuch as it gave an increased income of $2.80. So long as the farm resource situation as well as input-output pattern remain unchanged, this plan would provide optimum returns. The increase in returns to the fixed farm resources was made possible by proper planning and mathematical accuracy of the technique in locating the optimum combination of farm enterprises. Linear programming is, thus, better suited to situations where there are large number of enterprises and multiple resource restrictions are faced. Budgeting analysis
may, however, be applied with convenience for the choice is to be made from among a few enterprises or in case where comparison of two practices or enterprises is involved. In short, budgeting process may be used to solve relatively simple farm problems and linear programming technique may be utilised for more complex and comprehensive farm situations.

**Principles of Pricing the Farm Resources**

Value of a resource depends upon the use we make of it. While planning a farm for optimal enterprise combination, a framework of resource restrictions and alternative enterprises, with their input-output coefficients, is set up. Within this framework, value of any resource depends upon:

1) Total production of all the resources put together in respect of marginal value productivities of enterprises included in the farm plan,

2) Relative scarcity of the particular resource in relation to other resource levels,

3) Intensity of demand for it (input) for various enterprises, and

4) Marginal value productivity of the enterprise for which the particular resource is the most limiting factor.

**Owned Resources**

For the purpose of farm planning, only the levels of resources meant to be utilised on the farm business are considered. These are equal to total available level less those needed for other purposes. These net levels of various resources are taken to be fixed in supply because they lack in mobility or have very little release value.
Cost of these resources is determined by opportunities available within the farm situation. More scarce or limiting is the factor, higher it will be priced. If resource level is abundant relative to demand, it is priced at zero opportunity cost.

In this farm situation (Jodhan -II), Z\textunderscore j - C\textunderscore j row of the final iteration (Table V-4) obtained through the linear programming analysis gave the following prices (opportunity costs) for various fixed farm resources:

<table>
<thead>
<tr>
<th>Resources</th>
<th>Opportunity Costs 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat land irrigated (P\textunderscore 14)</td>
<td>126.74 per acre</td>
</tr>
<tr>
<td>Wheat and gram land unirrigated (P\textunderscore 15)</td>
<td>121.00 &quot; &quot;</td>
</tr>
<tr>
<td>Gram land irrigated (P\textunderscore 16)</td>
<td>7.68 &quot; &quot;</td>
</tr>
<tr>
<td>Sugarcane Rabi land (P\textunderscore 17)</td>
<td>43.00 &quot; &quot;</td>
</tr>
<tr>
<td>Maize and cotton land (P\textunderscore 18)</td>
<td>0</td>
</tr>
<tr>
<td>Sugarcane Kharif land (P\textunderscore 19)</td>
<td>0</td>
</tr>
<tr>
<td>Groundnut land irrigated (P\textunderscore 20)</td>
<td>0</td>
</tr>
<tr>
<td>Groundnut land Unirrigated (P\textunderscore 21)</td>
<td>0</td>
</tr>
<tr>
<td>Mid. March - Mid. April labour (P\textunderscore 22)</td>
<td>0</td>
</tr>
<tr>
<td>Mid. April - End April labour (P\textunderscore 23)</td>
<td>0</td>
</tr>
<tr>
<td>Mid. October - Mid. November labour (P\textunderscore 24)</td>
<td>1.63 per man hr.</td>
</tr>
<tr>
<td>Mid. Nov - Mid. March labour (P\textunderscore 25)</td>
<td>0.38 &quot; &quot;</td>
</tr>
<tr>
<td>Picking labour for cotton (P\textunderscore 26)</td>
<td>0</td>
</tr>
<tr>
<td>Irrigation Capacity per week (March-July)(P\textunderscore 27)</td>
<td>120.73 per acre</td>
</tr>
<tr>
<td>Fertilizer capacity of farm (P\textunderscore 28)</td>
<td>6.07 per ton</td>
</tr>
<tr>
<td>Kharif Season Cash (P\textunderscore 29)</td>
<td>2.71 per rupee</td>
</tr>
<tr>
<td>Rabi Season Cash (P\textunderscore 30)</td>
<td>0</td>
</tr>
</tbody>
</table>

For the owned fixed resources, it is not appropriate to consider prices by employment outside the farm. The opportunity costs of these resources as they emerge out of the framework of a particular farm situation should be taken as the real prices for the purpose of farm planning. These resource prices should form the basis to determine enterprise combinations.

1. Opportunity costs in the final iteration (Table V-4) are worked upto six decimal points. Here rounded figures upto 2 decimal points only are given.
where it is intended to rent out the owned resources, these opportunity costs would help to determine the factor prices. If the rental for the marginal units of different resources are more than their opportunity costs (marginal value productivities) within the farm situation, it is profitable to rent them out. Otherwise, the resource provided higher returns by employment within the farm, if its MVP is higher than the prices obtainable by off the farm employment.

**Purchased Resources**

The farm organizer has to often decide, how much of a resource he should buy. Linear Programming analysis can help him in making such decisions. Taking an example from the farm situation Jodhan - II, opportunity cost of farm yard manure was obtained at Rs.6.07 per ton (Table 7 - 4). This gave an indication that the farm yard manure should not be purchased at a price higher than Rs.6.07 per ton. As the farm yard manure was available at Rs.3.00 per ton, a purchase activity for the manure \( (P_m) \) was incorporated in the programme. The results obtained (Table V-5) included 3.12 tons of purchased farm yard manure \( (P_m) \), and reduced the opportunity cost of the manure \( (P_{O,y}) \) to Rs.3.99 per ton. This indicated that the additional unit (ton) of farm yard manure should not then be purchased at a price higher than Rs.3.99.

Strictly speaking, opportunity costs (Marginal Value Productivities) given by \( Z_j - C_j \) row provide guide lines for hiring or purchasing the limiting factors or production. These opportunity costs indicate whether purchasing of certain resources will be profitable or not. If so, at what maximum
price the marginal unit of a resource should be purchased. The resources with zero opportunity costs are in excess of what the farm can utilize. Question of their purchase, therefore, does not arise. It would be rather profitable to rent them out at whatever price could be obtained for them.

Only the resources with positive opportunity costs are profitable to be purchased and at prices not more than the marginal value productivities of the resources. For a resource to be purchased, price is determined by the market supply and demand forces. Individual farm situation determines whether to purchase additional units or not and at what price.