Lecture No.16

Farm planning and control - Elements of planning, objectives, steps and formulation of farm plans - Farm level management information systems.

A. FARM PLANNING

Farm planning is a decision making process in the farm business, which involves organization and management of limited resources to realize the specified goals continuously. Farm planning involves selecting the most profitable course of action from among all possible alternatives.

i) Objectives of Farm Planning

The ultimate objective of farm planning is the improvement in the standard of living of the farmer and immediate goal is to maximize the net incomes of the farmer through improved resource use planning. In short, the main objective is to maximize the annual net income sustained over a long period of time. The farm planning helps the cultivator in the following ways:

a) It helps him examine carefully his existing resource situation and past experiences as a basis for deciding which of the new alternative enterprises and methods fit his situation in the best way.

b) It helps him identify the various supply needs for the existing and improved plans.

c) It helps him find out the credit needs, if any, of the new plan.

d) It gives an idea of the expected income after repayment of loans, meeting out the expenditure on production, marketing, consumption, etc.

e) A properly thought of a farm plan might provide cash incomes at points of time when they may be most needed at the farm.

A farm plan is a programme of total farm activities of a farmer drawn out in advance. An optimum farm plan will satisfy all the resource constraints at the farm level and yield the maximum profit.

ii) Characteristics of a Good Farm Plan

A good farm plan generally should have the following characteristics:

a) An element of flexibility in a farm plan is essential to account for changes in the environment around the farm.

b) A farm plan should maximize the resource use efficiency at the farm.

c) It should provide for the attainment of the objectives of profit maximization through optimum resource use and balanced combination of farm enterprises.

d) Risk and uncertainty can be accounted for in a good farm plan.

e) The plan helps in timely acquisition and repayment of farm credit.

iii) Components of Farm Planning: Any systematic farm planning necessarily has the following five components:

a) Statement of the objective function: Many farmers aim at profit maximization. However, some farmers do not go all out to maximize their profits, but have objectives like cereal requirements for the family and fodder needs for the livestock.

b) Inventory of scarce resources and constraints

1) Land: Location, topography, soil type, fertility, drainage, irrigation systems and so on affect enterprises in many ways and hence, it is useful to divide all the land on a farm into different enterprises.

2) Labour: On subsistence farms, all labour is supplied by the farmer and his family. Thus, it is important to record the number of workers - male, female and children - and the type of manual work each is prepared is undertake. However, in commercial farms, hired labour constitutes a major component of costs and thereby inviting more attention in the planning process.

3) Capital: Whether fixed, like buildings and machines, or circulating, like cash in hand or in the bank, capital acts as a very powerful constraint.

4) Personal: Farmers' past experience, attitude towards risks and uncertainties and personal likes and dislikes influence the choice of enterprise.

5) Institutional: Market often serves as a constraint for the production of vegetables, poultry, milk, etc. Even if the location of the farm is suitable for a particular crop (commodity), a contract may still have to be obtained. E.g. Sugarcane growing near the sugar mills. Similarly, though many parts of Himachal Pradesh are suitable for poppy cultivation, the government has banned its cultivation.

6) Rotations: Maximum permissible area under a particular crop in a given season or minimum area constraints imposed on the acre under some crops like legumes would serve in maintaining soil fertility and help controlling pest and diseases.

3) Alternative Choices: Alternative choices in planning refer to the various enterprises, crops and livestock, which can be considered for attaining the stated objectives. There are alternate ways to use the scarce farm resources. There may be more than one ways to produce the same enterprise. A comprehensive list of different alternative enterprises can be prepared.

4) Input Output Co-efficients: The requirements of each of the several scarce resources and the financial returns per unit of each enterprise or activity need to be considered here. The precision in planning depends more on accurate input-output data than on the technique of planning.

5) Planning Technique: With a proper understanding of the planning environment and use of precise input-output data along with true and realistic constraints, sophisticated techniques give better results. However, common sense in the planning process could lead to fairly good results. Some of the farm planning techniques are as listed below:

1. Budgeting.

2. Linear Programming.

Budgeting is most informal of all the planning techniques and the level of sophistication gradually increases as we move from budgeting to linear programming.

iv) Steps in Farm Planning: The various steps involved in planning are discussed below:

a) Planning: This includes the identification and definition of the problem, collection of information, identifying alternative solutions and analyzing each alternative. Planning is the basic management function as it means deciding on a course of action, procedure or policy. The control function is a source of new information, as the results of the initial plan become known.

b) Implementation: Once the planning process is completed, the best alternative must be selected and action should be taken to place the plan into operation. This requires the acquisition and organization of necessary land, labour, capital and other inputs. An important part of the implementation function is the financing of the necessary resources.

c) Control: This provides for observing the results of the implemented plan to see if the specified goals and objectives are being met. Many things can cause a plan to go “off its track”. Price and other changes, which occur after the implementation of the plan, can cause the actual results to deviate from the expected. Control requires a system for making regular checks on the plan and monitoring progress and results as measured against the established goals. The dashed line in the chart represents the continuous flow of information from the

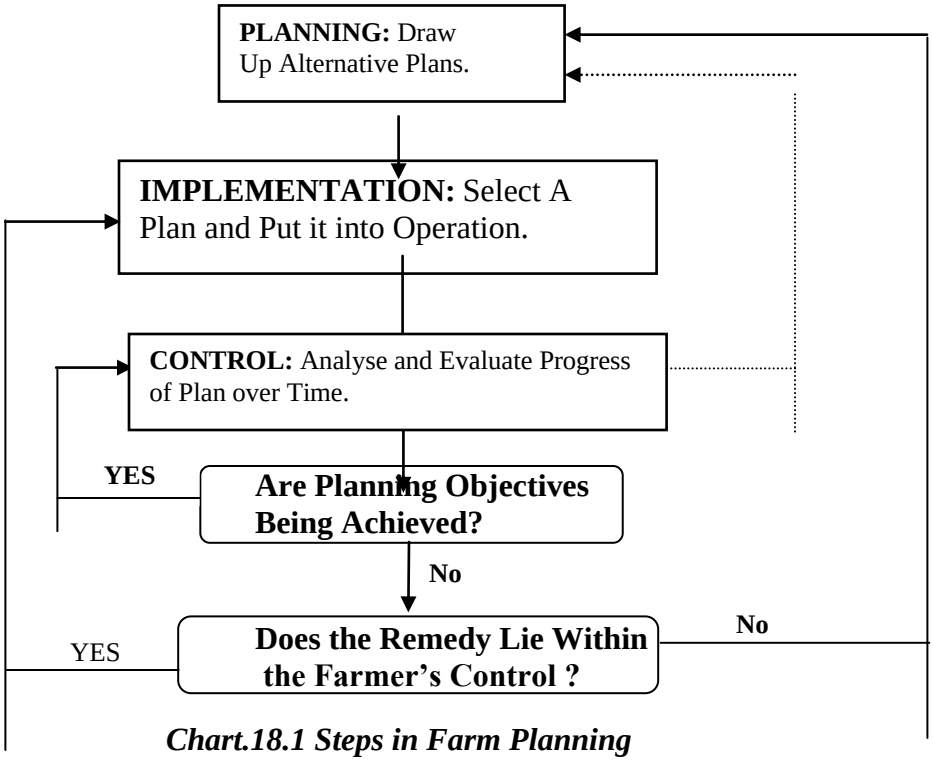

Chart.18.1 Steps in Farm Planning

control function back to planning, an important part of the total system. Without some feedback procedure, the information obtained by the control system is of no use in making corrections in the existing plan or improving future plans. This feedback sets up a continuous cycle of planning, implementation, monitoring and recording progress, followed by a reevaluation of the plan and the implementation procedures using the new information obtained through the control function.

viii) Depreciation

Depreciation is the decline in the value of a given asset as a result of the use, wear and tear, accidental damages and time obsolescence. The loss in value of an asset over time is, therefore, determined by i) remaining life, ii) extent and nature of use and iii) obsolescence. The relative importance of the above factors varies with the kind of assets and the extent to which it is put into use. Depreciation charges may either be spread uniformly over the entire useful life of an asset or they can be relatively heavier during the early life of an asset. The amount of depreciation charged should correspond to the loss in the value of asset over time. The computation of depreciation would not be necessary, if all items purchased were completely worn out by the end of the year of its purchase. However, the items such as buildings, equipments, livestock, etc are used up gradually over a long period of years and an important question arises about the determination of cost of such articles for one specific accounting year.

The span of an asset can be examined in two ways. In developing economies, any asset once acquired remains in use so long as it can be kept in use. But in developed countries, new

improved assets, especially machines that provide more efficient and economical services, are continuously developed and the farmer replaces much before its full working life, even while it is in working condition. The "time" depreciation in such cases known as obsolescence is equally important as that of "use" depreciation. While considering life span (or working life) of an asset, the past experience (or experience of the neighbouring farmers) and the expert opinion (of engineers) should be sought. The chance of obsolescence and the residual (or junk or scrap or salvage) value should also be carefully considered. The value of the asset may become completely exhausted or reduced to its junk value at the end of its useful life.

a) Calculation of Depreciation

Depreciation charges are merely a method of distributing the cost of the assets over the period of their use. Both the elements of depreciation, viz., use and time should be considered in working out the depreciation. There are three methods of calculating annual depreciation as discussed below:

1.Straight-Line Method: This method is relatively easy and simple to understand. The annual depreciation of asset is computed by dividing the original cost of the asset less salvage value by the expected years of life.

$$\textbf{Annual Depreciation (AD)} = \frac{\textbf{Original Cost (OC) – Salvage Value (SV)}}{\textbf{Expected Years of Life (EL)}}$$

$$AD = \frac{12000 - 1200}{10} = \text{Rs. } 1080 \text{ per year.}$$

The life of the asset may be calculated in terms of years (time) or units of production, viz., acres or hours of work. In case of tractor, its life may be 10 years or 10,000 hours of work. The actual depreciation of the asset may not be uniform in value every year during the entire useful life of an asset. It may be more during the early years, when asset depreciates at a faster rate and less in the later years of its life. It can be the other way also. Thus, the straight-line method may not be realistic for the estimation of depreciation of all assets. However, it may be suitable to long lasting assets like buildings and fences, which may require uniform maintenance during their lifetimes.

2.Declining or Diminishing Balance Method: In this method, a fixed rate of depreciation is used every year and applied to the remaining value of the asset at the beginning of each year. It is important to note that salvage value is not subtracted from the original cost as in straight-line method. A fixed rate of depreciation which should be nearly twice that is used under the straight-line method is applied to uncovered balance amount every year until the salvage value is reached and after that no depreciation is worked out. The annual depreciation under this method is estimated as follows:

$AD = (OC – D) \times R$

Where, OC- Original Cost; D – Accumulated depreciation occurred in prior years; and R- Rate of Depreciation.

In this method, the amount of depreciation decreases year after year and ultimately the asset is reduced to its junk value. This method may be suitable to those assets which depreciate at a faster rate in the beginning of their lives. E.g. Tractor, pump-set, etc. Assume a Rs.12,000 worth of an oil engine with an expected life of 10 years and salvage value of Rs.1,200.

The rate of depreciation would obviously be 20 per cent for this method as 10 per cent was used under straight-line method.

3.Sum-of-the-Year Digit Method (or) Reducing Fraction Method: If it is desired to distribute depreciation charges more heavily in the earlier life of an asset and more lightly in the later years, the sum-of-year-digits method can be

AD = (OC – SV)

SD

Table 16.1 Estimation of Annual Depreciation using
Diminishing Balance Method

Year	Value at the Beginning of the Year (Rs)	Annual Depreciation (Rs)	Remaining Balance (Rs)
1	12,000.00	12,000.00x0.2=2,400.00	9,600.00
2	9,600.00	9,600.00x0.2=1,920.00	7,680.00
3	7,680.00	7,680.00x0.2=1,536.00	6,144.00
4	6,144.00	6,144.00x0.2=1,228.80	4,915.20
5	4,915.20	4,915.20x0.2=983.04	3,932.16
6	3,932.16	3,932.16x0.2=786.43	3,145.73
7	3,145.73	3,145.73x0.2=629.15	2,516.58
8	2,516.58	2,516.58x0.2=503.32	2,013.26
9	2,013.26	2,013.26x0.2=402.65	1,610.61
10	1,610.61	1,610.61x0.2=322.12	1,288.49

used. As no undistributed balance is left over in this method, it has an advantage over the diminishing balance method. In case of declining balance method, the value at the end of the useful life is different from the expected salvage value. By this method, the annual depreciation is found out by multiplying a fraction by the amount to be depreciated (original cost minus salvage value).
N – The years of life remaining at the beginning of accounting period.
SD – The sum of the years of life of the asset
In this method, the digits upto the expected life of the asset are added (the digits can be summed

up using a formula i.e., n (n+1) / 2; where n is the total number of years of life). As the value of the fraction N/SD keeps on declining each year, the annual depreciation also declines with the advancement in the age of an asset as in the declining balance method.

Assume an oil engine with the original cost of Rs.12,000, an expected life of 10 years and salvage value of Rs. 1,200. Annual depreciation for this asset over its life can be calculated as shown in the table below:

This method also suits those assets for which relatively higher depreciation needs to be charged during earlier years of their lives. This method differs from the declining balance method in that the rate of decline in depreciation is uniform from year to year whereas in the declining balance method, it keeps on.

Lecture No 17.

Farm Budgeting ? partial, enterprise and complete budgeting.

B. BUDGETING

It may be defined as a detailed physical and financial statement of a farm plan or of a change in farm plan over a certain period of time. Farm budgeting is a method of analyzing plans for the use of agricultural resources at the command of the decision-maker. In other words, the expression of farm plan in monetary terms through the estimation of receipts, expenses and profit is called farm budgeting.

i) Types of Farm Budgeting: The following are the different types of farm budgeting techniques:

a) Partial Budgeting.

b) Enterprise Budgeting.

c) Cash flow Budgeting.

d) Complete Budgeting.

a) Partial Budgeting: This refers to estimating the outcome or returns for a part of the business, i.e., one or few activities. A partial budget is used to calculate the expected change in profit for a proposed change in the farm business. A partial budget contains only those income and expense items, which will change, if the proposed modification in the farm plan is implemented. Only the changes in income and expenses are included and not the total values. The final result is an estimate of the increase or decrease in profit. In order to make this estimate, a partial budget systematically, answers to following four questions relating to the proposed change: 1) What new or additional cost will be incurred? 2) What current income will be lost or reduced? 3) What new or additional income will be received? and 4) What current costs will be reduced or eliminated? The first two questions identify changes which will reduce profit by either increasing costs or reducing income. Similarly, the last two questions identify factors which will increase profit by either generating additional income or lowering costs. The net change in profit can be computed by estimating the total increase in profit minus the total reduction in profit. A positive value indicates that the proposed change in the farm plan will be profitable. All the changes in farm plan that can be appropriately adapted with the help of a partial budget can be grouped into three types. They are as given below:

1) Enterprise substitution: This indicates a complete or partial substitution of one enterprise for another. E.g. substituting one acre of paddy for one acre of

sugarcane.

2) Input substitution: Changes involving the substitution of one input for another or the total amount of input to be used are easily analyzed with a partial budget. E.g. substituting machinery for labour.

3) Size or scale of operation: Included in this category would be changes in total size of the farm business or in the size of a single enterprise. E.g. Buying or renting additional land or machinery.

Table 18.1 Introduction of Soyabean as an Intercrop in Sugarcane

Debit (Added Cost)	**Amount (Rs)**	**Credit (Added Return)**	**Amount (Rs)**
1. Increased Cost:	280.00	1. Added Return	1200.00
i) Labour			
ii) Seed	20.00	2. Reduced Cost	-
Sub- Total	300.00	Total	1200.00
2. Reduced Return	-		
Total	300.00		
Net change in income=Added return – Added cost = Rs. 1200 – 300 = Rs. 900			

i) Limitations of partial budgeting technique

1. Partial change does not always provide a complete solution.

2. The results of partial budgets are subject to variations in output - input prices, availability of resources and variations due to soil type, soil fertility etc.

b) Enterprise Budgeting: Enterprise is defined as a single crop or livestock commodity. Most farms consist of a combination of several enterprises. An enterprise budget is an estimate of all income and expenses associated with a specific enterprise and an estimate of its profitability. It is pre-requisite for the preparation of a complete farm budget or for the application of farm planning techniques like linear programming. An enterprise budget lists down all the expected output, both in physical as well as value terms, for a unit of a particular activity (i.e., per hectare, per animal or per 100 birds) on the farm. The enterprise budget is important since it depicts the relative profitability of different enterprises or activities or alternatives, which can be used to determine the relative dominance of different enterprises. It includes variable cost or total operating cost and fixed cost including depreciation and interest on fixed asset. Any enterprise budget can also be analyzed in terms of cash versus non-cash

expenses and total cost versus actual cash outlay.

Table 18.2 Enterprise Budget for Irrigated Ground - Nut

Particulars	Amount (Rs)
I Returns	
1. Main product	6277
2. By product	524
3. Gross return	6801
II Cost	
1. Land revenue	21
2. Seed	1245
3. Manures and fertilizers	530
4. Plant protection chemicals	98
5. Irrigation charges	190
6. Machine power	206
7. Bullock power	304
8. Human labour	1617
9. Interest on working capital	128
10. Depreciation on buildings and machineries	125
11. Interest on Fixed capital	725
Total cost	5189
Net return	1612

c) Cash - Flow Budgeting: It is essential to know about cash flow statement before using the cash flow budgeting.

1) Cash Flow Statement: It summarizes the magnitude of cash inflows and outflows over a period of time.

2) Importance of cash flow Statement: It helps to assess: i) whether cash would be available in correct quantity at right time; ii) whether the surplus could be profitably diverted and iii) timing and magnitude of borrowings required. The cash flow statement may be constructed over annually, quarterly, monthly and weekly depending upon the nature of business.

i) Cash inflows represent the amount of cash received during the particular time period. It includes: a) the beginning cash balance, b) receipts through sales of farm and non-farm assets and c) receipts of short term (operating), intermediate and long term loans.

ii) Cash Outflows represents the expenses incurred in a given period of time. It includes: a) Cash expenses (variable cash expenses, fixed cash expenses, non-farm investment, and personal expenses), b) Repayment on operating (crop) loans and c) repayment on intermediate and long-term loans.

Cash flow analysis indicates the amount of cash flowing into and out of the farm business over a specific period of time. Cash flow statements and income statements both show inflows and outflows of money, but differ in their treatment of several important accounting entries. A cash flow statement includes non-farm items such as income taxes, non-farm income and living expenses and gives a complete accounting of debt transactions by showing principal payments and proceeds of new loans, whereas the income statement shows only interest payments.

3) Cash Flow Budgeting: A cash flow budget is a summary of the cash inflows and outflows for a business over a given time period. As a forward planning tool, its primary purpose is to estimate future borrowing needs and the loan repayment capacity of the business. Cash flow budgeting is to assess the whole farm plan.

Table 18.3 Simplified Cash-Flow Budget

(Amount in Rs)

Particulars	**Time Period I**	**Time Period II**
1. Beginning cash balance	1000	1000
Cash inflow		
2. Farm products sales	2000	12000
3. Capital sales	0	4500
4. Miscellaneous cash income	0	500
5. Total cash inflow	3000	18000
Cash outflow		
6. Farm operating expenses	3500	1800
7. Capital purchases	10000	0
8. Miscellaneous expenses	500	200
9. Total cash outflow	14000	2000
10. Cash balance (5 – 9)	- 11000	16000
11. Borrowed funds needed	12000	0
12. Loan repayment (principal and interest)	0	12720
13. Ending cash balance (10 + 11 – 12)	1000	3280
14. Debt outstanding	12000	0

Here, two time periods are considered. In the time period I, there is Rs.3,000 cash inflow and Rs.14,000 cash outflow, leaving a projected cash balance of - Rs.11,000. This would require a borrowing of Rs.12,000 to permit Rs.1000 minimum ending cash balance. The total cash outflow in the period II is Rs.18,000 which leaves a projected cash balance of Rs.16,000 and it permits paying off the debt incurred in period I, estimated at Rs.12,720 when interest is included. The

final result is an estimated Rs.3,280 cash balance at the end of second period. The primary use of a cash flow budget is to project the timing and amount of new borrowing; the business will need during the year and the timing and amount of loan repayments.

d) Complete or Whole Farm Budgeting: It is a technique for assembling and organizing the information about the whole farm in order to facilitate decisions

Table 18.4 Complete Budget Showing Projected Income, Expenses and Profit.

Particulars	**Amount (Rs)**
I Income: i) Cotton	54,000
ii) Paddy	43,000
iii) Sorghum	13,500
iv) Dairy products	40,000
Total income	150,500
II Variable Expenses: i) Fertilizers	11,900
ii) Seeds	3,600
iii) Plant protection chemicals	7,900
iv) Fuel and oil	4,050
v) Machine repairs	2,650
vi) Feed purchase	1,600
vii) Veterinary expenses and other expenses	30,100
viii) Custom hire charges	10,250
ix) Miscellaneous expenses	2,450
Total variable Expenses	74,500
III Fixed Expenses: i) Tax	2,600
ii) Insurance	1,250
iii) Interest on debt	22,000
iv) Machinery depreciation	7,200
v) Building depreciation	3,200
Total fixed expenses	36,250
Total expenses	110,750
Net Farm Income (Rs. 150,750 – 110,750)	39,750

about the management of farm resources. It attempts to estimate all items of costs and returns and it presents a complete picture of farm business. It is generally used by beginners or by those farmers who want to completely overhaul their existing farm organization and operation. Complete and partial budgeting are mutually complementary, i.e., the partial budgeting should be used at various stages of complete budgeting in order to decide the changes to be effected in the

farm organization. The process of complete budgeting involves: i) appraisal of existing farm resources, their uses and efficiency, ii) appraisal of alternatives or opportunities or various production activities that can be included and their resource requirements and iii) preparing and evaluating the alternative plans for their feasibility and profitability. The above table shows an estimated profit or net farm income of Rs.39,750, if the prices and yield are actually realized. Changes in any of these factors will obviously affect the actual profit received from operating the farm under this plan.

1) Uses: i) It provides a basis for comparing alternative plans for profitability. This can be particularly useful when planning is carried out for growth and expansion.

ii) A detailed whole farm budget showing the estimated profit can be used to borrow the necessary operating capital.

2) Complete Budgeting and Partial Budgeting: The difference between these two are: i) Complete budgeting accounts for drastic changes in the organization and operation of the farm, while partial budgeting treats minor changes only. ii) All the available alternatives are considered in complete budgeting, whereas partial budget considers two or a few alternatives only. iii) Complete budgeting is used for estimating the results of entire organization and operation of a farm, while partial budget helps only to study the net effects in terms of costs and returns of relatively minor changes.

e) Linear Programming: George Dantzing (1947) developed the simplex method for optimal transport of ammunition quickly with minimum cost. Linear programming is a mathematical method of analysis, which finds the "best" or optimal combination of business activities to meet a certain objective. Three components are needed to solve a problem with linear programming technique. They are: 1) a desire to maximize or minimize some objective, 2) a set of activities or processes available to accomplish this objective and 3) a set of constraints or restrictions that limit one's ability to achieve this objective.

1) Basic assumptions of Linear Programming

i) Proportionality or linearity: Linear relationship exists between activity and resource. For example, if one acre requires 30 man days, 100 Kgs of nitrogen and Rs.60 of other variable expenses to produce 20 quintals of maize output, then 10 acres of maize would require exactly 10 times of each resource to produce 200 quintals of output.

ii) Additivity: The total amount of resources used by several enterprises on the farm must be equal to the sum of resources used by each individual enterprise. Hence no interaction is possible. The same is true for the products also.

iii) Divisibility: Fractions can be used and enterprises can be produced in fractional units. Resources and products are infinitely divisible.

iv) Non-negativity: None of the activity is negative.

v) Finiteness: Number of activities and constraints are finite.

vi) Certainty: Almost all planning techniques assume that resources, supplies, input - output coefficients and prices are known with certainty.

2) Concepts used in Linear Programming

i) Solution: A solution refers to any set of activities Xj, j = 1, 2, 3, ..., n, which satisfies a system of inequality constraints. There may be innumerable solutions to a given linear programming problem.

ii) Feasible Solution: Any solution to a linear programming problem is said to be feasible, if none of the Xj is negative.

iii) Infeasible Solution: It refers to a solution, where some of the variables, Xjs, appear at a negative level.

iv) Optimum Solution: One of the feasible solutions is optimum, provided a feasible solution exists. Such a feasible solution, which optimizes the objective function, is called an optimum solution. The set of Xj in this case satisfies the set of constraints and non-negativity restrictions and also maximizes the objective function.

v) Unbounded Solution: Many a time, faulty formulation of a linear programming problem may result in an arbitrarily large value of the objective function and the problem has no finite maximum value of profit. It represents a case of unbounded solution to a linear programming problem.

3) Estimation of Optimum Solution using Linear Programming: The estimation of optimal solution using linear programming is given in table 18.5.

Table 18.5 (a) Estimation of Optimum Solution using Linear Programming

Particulars	Per Acre of Paddy	Per Acre of Ground-Nut
Income and Expenses		
1. Gross income	2600	2000
2. Total cost	1100	600
3. Net income	1500	1400
Resource Requirements		
1. Acres of crop- land	1	1

2. Hours of labour during harvesting	45	60
3. Rupees of operating capital	1100	600

Table 18.5 (b) Estimation of Optimum Solution using Linear Programming

Particulars	Amount Available	Paddy		Ground-nut	
		Per Acre Needs	Maximum Area (Acres) Required	Per Acre Needs	Maximum Area (Acres) Required
1. Maximum land.	4 acres	1	4.00	1	4.00
2. Maximum hours.	225 hours	45	5.00	60	3.75
3.Maximum operating capital.	Rs. 3500	1100	3.18	600	5.83

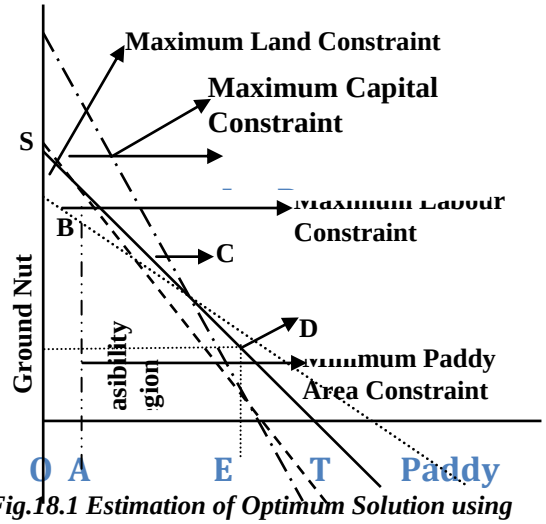

Fig.18.1 Estimation of Optimum Solution using Linear Programming Technique

There is also one additional restriction the farmer wants to incorporate into the analysis. He wants a farm plan that has at least 0.7 acres of paddy. The line that connects points A, B, C, D and E in the figure 18.1 defines an area which contains all numerous combinations of paddy and groundnut that can be produced on this farm. This region is called the feasible region of production. At any point outside this line, the farmer could not produce that combination of paddy or groundnut without isolating any one of the constraints.

In order to complete the graphic analysis, it is necessary to find out the optimal combination of paddy and groundnut that maximizes the net return to the fixed resources of land, labour and operating capital and minimum acreage requirements. This is done by defining a line that will give a constant amount of net revenue, given different acreage combinations of paddy and groundnut. The slope of the iso revenue line is calculated by the following equation:

$$\text{Slope of Isorevenue Line} = \frac{\text{Net Revenue for Paddy}}{\text{Net Revenue for Ground Nut}} = \frac{1500}{1400} = 1.071$$

Since the iso revenue line indicates a set of net revenues, it is the farmer's desire to find an iso revenue line as far away from the origin as possible. The farther away the iso revenue line, the greater the net income. In addition, he needs to be concerned that the iso revenue line is within

the feasible region of production. The iso revenue line S and T fulfils both of these requirements. Thus, the production levels indicated at corner point D achieves the maximum level of net Income.

Table 18.6 Optimum Solution Using Graphical Method of Linear Programming

Particulars	Non Optimal Plans				Optimal Plan
	A	B	C	E	(D)
1. Acres of Paddy	0.70	0.70	1.00	3.18	2.20
2. Acres of ground nut	0.00	3.23	3.00	0.00	1.80
3. Total net income (Rs)	1050	5565	5700	4770	5820
4. Total crop land used	0.70	3.93	4.00	3.18	4.00
5. Total harvesting labour used	31.5	225	225	143	207
6. Total operating capital used	770	2705	2900	3500	3500

The optimal plan is growing of 2.20 acres of paddy and 1.80 acres of groundnut. It has a total net income of Rs.5620. This plan utilizes all the 4 acres of crop land and Rs.3500 of capital. However, not all labour is used in this plan, with 18 hours being unused (225 - 207). The non-optimal plans like A, B, C and E have lesser net income than that of optimal plan (D).

4) Limitations of Linear Programming

i) Computational difficulties are enormous (unbounded solution may occur)

ii) It does not take into account the time.

iii) Several real world situations are non-linear and in Linear Programming, only linear equations are solved.

iv) Application of Linear Programming to the macro model is very difficult. Rounding up of the solutions of variable will alter the value of optimal solution.