

Lecture No.3.

Basic concepts in farm management. Production, types of resources, choice indicators, costs, revenue, profit, total, average & marginal concepts.

BASIC CONCEPTS OF FARM MANAGEMENT

The basic concepts that are frequently used in farm management are discussed below:

i) Farm-Firm: Farm means a piece of land where crop and livestock enterprises are taken up under a common management. A farm is a firm which combines resources in the production of agricultural products on the lines of a business firm, i.e., with the objective of profit maximization.

ii) Resources or Inputs or Factors of Production: Resources are those which get consumed or transformed into products in the process of production. Services of resources are also used up in the production process. All agricultural resources can be classified into two types. They are i) fixed resources and ii) variable resources.

a) Fixed resources: Level of some resources like buildings, machinery, etc. is fixed over a production-planning period irrespective of the level of enterprises taken up. These are called fixed farm resources, E.g. Land, building, machineries, etc. The quantum of fixed resources does not change with the level of production. Some of the resources, which are fixed during a short period, may become variable during a long term.

b) Variable resources: Some resources like seed, fertilizer, labour, etc vary with the level of output. These are variable resources.

Resources can also be classified into stock and flow resources as detailed below:

a) **Stock resources:** They are resources which are used up entirely in the production process. Fertilizer, seed, feed, etc., are such resources that can be stored up for using at later period.

b) **Flow resources:** Contrary to stock resources, there are factors of production which give only flow of services in the production process. Hence, they are called the flow resources. If the services of this category of resources are not utilized, they go waste, as they cannot be stored up for later use. For example, if the services of a farm building or machinery are not used in a particular day, they go waste, as they cannot be stored up for future use.

iii) Ways of Mobilizing Farm Resources: The different types of farm resources and ways of mobilizing them by a farm manager are discussed here.

a) **Owning:** Resources like land, machinery, implements, tools, work bullocks, etc, can be acquired by purchasing them. Farmers can own these resources due to the following reasons:

- 1) The resources are to be continuously or more frequently used throughout the year. The size of holding should be large enough to effectively use such assets.
- 2) If the farmer could not engage work bullocks, tractors/power tillers, power sprayers, bullock cart and so on in his own farm economically, adequate demand should be there for hiring out these resources.
- 3) The farmer should have either adequate owned funds or borrowed funds to acquire these resources.

Owning of resources would be convenient to the farmer especially during peak season so as to carry out the farm operation in time. However, during lean season, it may be uneconomical to maintain owned resources. E.g. Bullocks, thresher, etc. Hiring would be cheaper than owning the resource especially, when the size of holding is too small.

b) **Leasing:** The immovable resources like land and buildings can be acquired by leasing. Rent has to be paid based on the terms agreed by the lessees (tenants) to the owner of such resources. The land owner may lease-out his lands to land less agricultural labourers or to farmers who are capable of cultivating larger area. The land owner leases out due to 1) his absenteeism at the village where his land is located, 2) inefficiency in running farm and 3) running of other more profitable enterprise in the same village. Sometimes, the widows and invalids may lease out due to their physical inability. Leasing-in helps lessees (tenants) to augment their farm returns. However, leasing-out becomes complicated due to improper implementation of agrarian laws which are more favourable to tenants. The fertility status of the leased-out land is gradually deteriorating because the tenants do not apply organic manure and they do not properly maintain the farm assets out of the fear of eviction from the land by the owner. Therefore, the productivity of leased-out land is lesser than that of owned land. On the contrary, as the tenancy legislations are more favourable to tenants, some of them refuse to surrender their tenancy rights to the owners and hence, the owners are reluctant to lease out their lands.

c) **Hiring:** The farmer can acquire human labour and bullock power through hiring. The magnitude of employment of hired human labour and bullock power depends upon: a) size of farm holding, b) number of family labourers available, c) availability of owned bullocks, d) resourcefulness of

the farmer to replace labour with capital and e) diversification of crop activities practiced in the farm. Hiring of human labour and bullock power is also difficult and costly during peak season due to either costly human labour as a result of heavy demand for such labour or difficulty in carrying the operations with human labour in time. However, hiring of human labour and bullock power is more economical than that of hired machinery to small and marginal farms, especially in areas where the labour is cheaper.

d) Joint ownership: When the land, buildings and well are inherited by legal heirs, the land gets sub-divided and buildings and wells are jointly owned among them. Joint ownership is convenient and economical to those who have small and fragmented inherited land. However, disputes arise due to lack of understanding among joint owners in sharing the services and also in the maintenance of the jointly owned assets.

e) Custom Services: Farmers could acquire custom services of machineries like tractor, power tillers, threshers, power sprayers, etc. by paying custom hire charges. Hiring of custom services of machineries depends upon 1) size of farm holding, 2) availability of alternatives such as human labour and bullock power, 3) hire charges for human labour and bullock power, 4) custom hire charges, 5) time of operation (peak or lean season), 6) availability of time to carry out the farm operation and 7) quantum of work to be carried out. Custom services would be more economical for small and marginal farms as they cannot afford to buy or maintain costlier equipments and machineries.

iv) Product or Output: It is the result of the use of resources or services of resources. The resources get transformed into what is known as output. E.g. Paddy, groundnut, sugarcane, milk, etc.

v) Production: It is a process of transformation of resources or inputs like labour, seed, fertilizer, water, etc. into products like paddy, wheat etc.

vi) Transformation or Production Period: The time required for a resource to be completely transformed into a product is called transformation or production period. E.g. Paddy is harvested in 3½ to 6 months.

vii) Production Economics: Farm production economics is a field of specialization within the subject of agricultural economics. It is concerned with choosing of available alternatives or their combinations in order to maximize the returns or to minimize the costs. Agricultural production economics is an applied field of science, wherein the principles of choice are applied to the use of land, labour, capital and management in farming. The

subject matter of production economics explains the conditions under which the profit, output, etc. that can be maximized and the cost, use of physical inputs, etc. that can be minimized. The main objectives of production economics are:

- a) to determine and define the conditions which provide for optimum use of resources;
- b) to determine the extent to which the current use of resources deviates from the optimum use;
- c) to analyze the factors which influence the existing production patterns and resources use; and
- d) to identify the means and methods for optimal use of resources.

The principles that help attain these objectives are the same on a micro as on a regional or national level. On micro level where intra-farm resource allocation and production pattern are involved, it is the subject matter of farm management. When choice principles involve a broader field on a macro-level, the subject is known as production economics. The economist who focuses his attention on individual farm cannot make rational recommendations unless he considers the aggregate or overall aspect of production. Similarly, government programmes and policies affect the decisions on the individual farms. Production economist, therefore, must be able to integrate both individual and aggregate aspects of agricultural resource use and levels and patterns of production.

viii) **Production Function:** Production function refers to input-output relationship in the production process. Production function is a technical and mathematical relationship describing the manner and extent to which a particular product depends upon the quantities of inputs or services of inputs used in the production process. It describes the rate at which resources are transformed into products. There are numerous input-output relationships in agriculture because the rates at which inputs are transformed into outputs will vary among soil types, animals, technologies, rainfall, etc. Any given input-output relationship specifies the quantities and qualities of resources needed to produce a particular product.

a) **Types of Production Function:** There are different types of production functions, viz., 1) continuous function and 2) discontinuous function.

1) **Continuous function:** The doses or levels of input and output can be split up into small units. E.g. Fertilizers or seed can be applied to a hectare of land in quantities ranging from a fraction of a kilogram upto hundreds of kilogram

2) **Discontinuous or Discrete function:** Such a function is obtained for input or factors or work units which are used or done in whole numbers such as one ploughing or a

number of ploughings.

The difference between discrete data and continuous data is, thus, in the divisibility of the inputs or outputs. An example of a discrete input is a cow. A dairy herd may be composed of two, three, or most cows. However, one and a half, three and a quarter, etc, will not be found in a dairy herd. Fertilizer on the other hand is an example of a continuous input. Fertilizer can be divided into any size unit and for each size unit, there is a resulting yield.

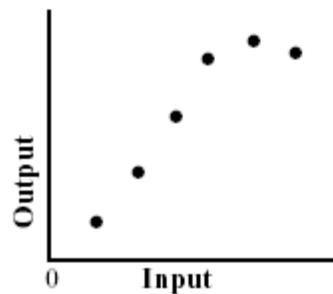


Fig.9.1 (a) Discrete Production Function

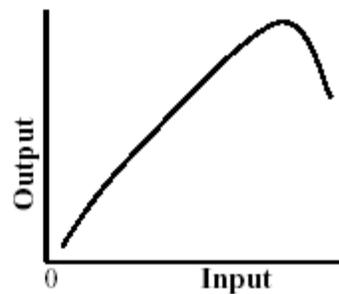


Fig.9.1(b) Continuous Production Function

The production function can also be classified into 1) very short run production, 2) Short run production function and 3) Long - run production function.

- 1) Very short run production function: The time period is so short that all resources are fixed.
- 2) Short run production function: Production function, which relates factors and products where some resources are fixed, can be termed as short run production function. The time period is of such length that at least one resource is varied while other resources are fixed.
- 3) Long - run production function: Production function, which permits variation in all factors (none is fixed), can be called long-run production function. The time is of such length that all resources can be varied.

The production function relates output (Y), to input (X). The definition of a function is as follows: If an output (Y) depends upon an input (X), then Y is called a function of X. The mathematical expression for a function is $Y = f(X)$. This functional notation is read, "Y is a function of X". Y is usually called the dependent variable, and X, the independent variable.) Subscripts: Subscripts are useful when symbols are used. Consider, for example, the notation for the production function $Y = f(X)$, where X is the amount of input and Y, the resulting amount of output. In this, there can be no confusion about identification of input or output because there is only one input and one output. When more than one input or output is included in a problem, subscripts can be used as a

means of identification. For example, when output is a function of three inputs, the production function can be written $Y = f(X_1, X_2, X_3)$, where X_1 , X_2 and X_3 are distinct and different inputs. X_1 may be seeds; X_2 may denote labour and X_3 may indicate fertilizer. If amounts are to be denoted, additional subscripts must be used. X_{11} is an amount of X_1 ; X_{12} is a greater amount of X_1 ; X_{21} is an amount of X_2 ; X_{22} is a greater amount of X_2 ; etc. Subscripts can also be used to identify outputs or any other variable. Thus, Y_1 , Y_2 and Y_3 can be distinct outputs and the amounts can be shown by adding another subscript.

c) The “ Δ ” (Delta) Notation: The change in any variable is denoted by “ Δ ” (the Greek letter “delta”) placed before the variable. For example, the change in the variable X is denoted by ΔX . Production function is written as: $Y = f(X_1, X_2, X_3, \dots, X_n)$ where, Y is output and X_1, \dots, X_n are different inputs that are used in the production of a product or output. The functional symbol “ f ” indicates the form of relationship that transforms inputs into output. For each combination of inputs, there will be a unique level of output. For example, Y may represent paddy yield, X_1 , quantity of seed, X_2 , quantity of fertilizer, X_3 , labour and so on. The above notation for a production function does not specify which inputs are fixed and which are variable. For example, seed or fertilizers are variable inputs that are combined with fixed input such as acre of land. Symbolically, fixed inputs can be included in the notation for a production function by inserting a vertical line between the fixed and variable inputs. For example, $Y = f(X_1, X_2, X_3, \dots, X_{n-1} | X_n)$ states that X_n is the fixed input while all other inputs are variable.

d) Forms of Production Function: The technical functional relationship between resources/inputs and product can be expressed by a functional form, a few of which are given below:

1) Linear: The simplest form of linear production function is $Y = a + bX$ with one variable input and $Y = a + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_nX_n$ with n variables. n

Symbolically, $Y = a + \sum_{i=1}^n b_i X_i$ - where, Y is output, a - constant, b_i - unknown $b_i X_i$.
 $i = 1$ parameters to be estimated and X_i - variable inputs. The estimated equation is:

$$Y = 0.2151 + 0.0412X_1 - 0.0002X_2 + 0.0752X_3 - 0.0066X_4 - 0.0880X_5$$

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$$R = 0.64; F = 3.56.$$

The values of X_i 's indicate the rate of change in Y due to one unit change in X_i 's. For example, an unit change in X_1 results in 0.0412 units increase in Y when all

other variable inputs are kept constant at their respective mean levels,

i.e., *ceteris paribus*.

2) Cobb-Douglas Production Function (or) Power Function: The power production function is a non-linear production function which is more commonly known as Cobb-Douglas production function, after the names of persons who first applied it for empirical estimation and it is represented as:

$$Y = AL^a K^b$$

Where, L and K are labour and capital respectively and Y, the output. A, a and b are parameters to be estimated. This can be generalized to 'n' inputs also.

$$Y = a_0 X_1^{a_1} X_2^{a_2} \dots X_n^{a_n} = a_0 \prod X_i^{a_i}, i = 1, 2, \dots, n.$$

Since the model in the above equation is in multiplicative form, it has to be converted into log-linear form so as to estimate parameters and it is given below:

$$\ln Y = \ln a_0 + a_1 \ln X_1 + a_2 \ln X_2 + a_3 \ln X_3 + \dots + a_n \ln X_n$$

$$\ln Y = \ln a_0 + \sum_{i=1}^n a_i \ln X_i, \text{ where, } i=1,2,3,\dots,n$$

In the above function, a_0 and a_i are the efficiency parameters and elasticity of production with respect to the input X_i , respectively. The result of the Cobb-Douglas production is as follows:

$$Y = 0.7342 X_1^{0.6315} X_2^{0.0234} X_3^{-0.0496} X_4^{0.1904} X_5^{0.0760} X_6^{-0.0286} X_7^{0.0871}$$

The regression co-efficients indicate the percentage increase in Y with respect to one per cent increase in the input X. For example, if we increase X_1 by one per cent, holding other resources at a constant level, Y will increase by 0.6315 per cent, thus showing diminishing return with respect to X_1 , say, land in hectares. The sum of elasticities turns out to be less than unit (0.9302), which indicates diminishing return to scale.

3) Quadratic Form: The quadratic equation $Y = a + bX_1 - cX_1^2$, with a minus before C denotes diminishing returns. It allows both a declining and negative marginal productivity, but not both increasing and decreasing marginal products.

ix) Total Physical Product (TPP): TPP is the quantum of output (Y) produced by a given level of input (X).

x) Average Physical Product (APP): APP is the quantity of output produced per unit of input i.e., ratio of the total product to the quantity of input used in producing that amount

of product.

$$APP = \frac{\text{Number of Units of Output } Y}{\text{Number of Units of Input } X}$$

xi) Marginal Physical Product (MPP): The term marginal refers to an additional unit. If we use Δ to mean “change in”, then ΔY and ΔX represent change in Y (output) and change in X (input) respectively. Marginal physical product, therefore, refers to the change in output, which results from applying an additional unit of input.

$$\text{Marginal Physical Product (MPP)} = \frac{\text{Change in Output } \Delta Y}{\text{Change in Input } \Delta X}$$