Risk and Uncertainty

Agricultural production is confronted with risk and uncertainty conditions. As agricultural production being biological and seasonal in nature, we don't know the nature of agricultural decisions and their possible outcomes. It is a highly difficult proposition to make right decisions when the production environment is risky and uncertain. Farmers are generally concerned with decisions on crops to be planted, seed rates, fertilizer application, application of other crucial inputs, *etc.* These decisions are subjected to change depending on the nature of weather risks and other associated risks. A livestock farmer has to take a number of decisions to expand his dairy cattle herd and he has to wait for several years to get back the investment and also income from the investment. Changes in the weather, prices and other socio-economic factors occur between time periods in which investment decisions are made and the final outcome. Due to this the farmers and ranchers have to consider various management strategies relevant to the risk and uncertainty conditions. If everything in farming and livestock rearing goes with certainty then every farmer becomes a better manager, but this is not the case with real farming situation. Only a few farmers can become efficient, particularly those who could understand risk and uncertainty situations in farming and ranching and follow the relevant risk management strategies. Let us now know about how risk is different from uncertainty.

Risk and Uncertainty: A contrast

Earlier, *i.e.*, in the past, the economists did not make any difference between risk and uncertainty. Only about three decades ago, economists made a clear-cut distinction between these two terms. According to recent view, risk is measurable, while uncertainty is not measurable. Risk is defined as a situation when all possible outcomes are known for a given management decision and probability associated with each possible outcome is also known. Risk is measured through probability concepts. Probabilities are assigned to the events. For example, probability of rain, weather forecast, *etc.* Subjective probabilities are based on judgment and experience of individuals and these may vary from individual to individual. Subjective probabilities are measurable through certain concepts, but uncertainty situation prevails when all the possible outcomes of events are unknown, then neither the probability nor the outcomes are known. It is also difficult to estimate the associated probabilities to the possible outcomes of the events. In that case, we assign subjective probabilities to make the best estimates of true probabilities based on the information and past experience. A pure risk situation is not seen in the real world, because the true

probabilities are not estimated for the ~~~~ ~~~~ ~~~ problem in a situation of risk. Now let us tive probabilities to solve the decision problem in a situation of risk. Now let us aware of different sources of risk.

SOURCES OF RISK

The various sources of risks are conveniently grouped into three categories viz., 1) Production risk or technical risk, 2) Price risk or marketing risk and 3) Financial risk.

1. Production Risk

In industrial businesses we have a technical input-output relationship with known quantity of output for a given quantity of input i.e., the production practices are standardized in industrial production. Such type of relationship does not exist in agricultural production. Output of crops and livestock is subject to change due to weather, disease, insects, weeds and inadequate technology. These factors cannot be predicted accurately and hence results in the variability of the output. In fact, the yield variations are due to many factors. Some are under control, while some others are not under the control of management. Thus, the production-risk is due to largely many factors rather than a single factor. Weather risk and technical risk are the most important components of production-risk. Yield risk may be arising due to change in production costs, institutional factors, changes in management, etc. Input-prices are subject to more variations than output prices some times. Then price trends also cause production risk. The cost of production for unit of output is also changing due to productivity levels and magnitude of costs both over time and space. When the technology is changing in a particular place, it would have greater bearing on pro-duction risk. The new technology, though it brings higher level of profit, it would also involve greater variation of the output. Because of this factor the farmers are reluctant to adopt technology as per expectation.

2. Price Risk or Marketing Risk

Marketing risk is also called as price risk because prices are determined due to interaction of demand and supply in the market. Production of crops and livestock is influenced by prices in the market which are beyond the control of farmers and the consumer's prices of commodities vary from year to year, season to season and exhibit seasonal variation. If there is less time lag between production and marketing activity, we could expect less price risk for agricultural commodities. But this is not the case with most of the agricultural commodities, because there is enough time for prices to fluctuate when the commodities move from production centre to consumption centre. Supply of the commodity is very much affected if there is a situation of weather risk and production risk. Demand for a commodity is mainly changing due to consumers' income, habits, tastes and preferences, export and import policies and overall, general economic measures taken up by the Government with regard to price stabilization. If there are less trade restrictions due to the increased demand in the foreign market, prices of commodities will be increasing. Similarly, in the domestic markets, if the commodity prices were very high, prices would be brought under control by import policy. Thus trade policy i.e., export import (Exim) policy would have a greater impact on price stabilization of commodities.

Financial Risk

This type of risk increases with increased amount of borrowed money in the farm business. This aspect is explained by the principle of increasing risk. According to this principle, if borrowing increases there would be greater risk of foregoing the equity capital in the event of losses and this leads to increase in the debt-equity ratio. For further details, see the principle of equity and increasing risk.

Uncertainty arises due to the changes in future interest rates and fiscal policies of RBI and finally changes in the ability of farm business to generate required cash flow for the clearance of debts. In farming and livestock rearing, all these types of risks are interrelated and mixed, for instance, the ability to repay the debt by the farmers depends on yield levels and favourable prices in the markets. Financing the production processes, and storing the commodities under scientific management require large amounts of borrowed capital. Hence a careful analysis is to be made considering all these types of risks including their sources to follow the relevant risk management strategies.

MEASURING THE EXPECTATION AND VARIATION

In the risky farm environments, the farmers make decisions using some kind of the expectations regarding prices, costs and yields. Here what we mean is that there is no assurance or certainty regarding actual facts of these things and the outcome of the farm decisions. Let us look into as to how the expectations and variations are worked out and used in the decision-making process. Expected values are worked out as proxy for best estimates of unknown future events, so that they become one of the important components of decision-making process.

Two types of averages are used to work out an expected value. We take the actual past prices (time series data) and yield to find out the simple average over the specific time period. Here, the problem is to decide on the number of years of data that should be considered to work out average. Here the choice depends upon the subjective estimate of the decision-maker. Second type of average is called weighted average. This method considers larger weights for the more recent data and smaller weights for the remote data. This is illustrated in Table 36.1.

TABLE 36.1   Working out Weighted Averages for the Prices.

Year	Average annual price of commodity (Rs.)	Weights	Price x Weight
1993	1,000	1	1,000
1994	1,200	2	2,400
1995	1,400	3	4,200
1996	1,100	4	4,400
1997	1,000	5	5,000
1998	1,300	6	7,800
	7,000	21	24,800
Simple average			1,166.67
Weighted average			1,180.95

For working out the simple averages we have taken sum of the annual average prices and divided by number of years i.e., (6). For working out weighted average we have to multiply the individual prices by weights, obtain the total and divide by the total of weight i.e., (21). Weighted average is the expected value regarding the price

of the commodity. For the given data there is no price risk for the commodity, as expected value is more than simple average. On the contrary, if there is price risk its expected value would be less than the simple average. We can also work out expectations through the concept of probabilities.

Expectation Through Probabilities

Another way of finding expectations is to choose the probability value, which is the most likely to occur for the given price or yield or cost. In this procedure, we have to elicit probabilities associated with each possible outcome (expected yield and expected price). The outcome with the highest probability would be selected as the most likely one to occur. This is shown in Table 36.2.

TABLE 36.2 Working out Expectations Through Probabilities.

Crop yield/acre in quintals	Probability	Probability x Yield
11	0.1	1.1
14	0.4	5.6
10	0.1	1.0
12	0.3	3.6
18	0.1	1.8
Mean 13	Total 1.0	13.1

From Table 36.2 it is clear that the most likely output based on the highest probability is 14-quintals/acre. Mathematical expectation of 13.1 quintal of commodity per acre is less than the most likely yield of 14 quintals per acre, but it is more than the average yield of crop *i.e.,* 13 quintals per acre.

Variability

Two factors *viz.,* the variance and the expected value, in general should form the basis for selecting the best enterprise among alternative risky enterprises. Range is a measure of variability and it refers to the difference between the lowest and the highest possible outcome. Alternative enterprises should be preferred which have got smallest range value, provided their expected values are the same. Similarly alternative enterprises with lowest variance should be selected.

MEASURES TO MANAGE FARM RISK

1. Diversification

Selection of suitable crop and livestock enterprises is the first step in diversification. Through diversification process, the farm entrepreneur produces several products rather than single product with the hope that when the returns from one enterprise is low, it is compensated by the higher returns from the other enterprise. Through diversification process we see that idle resources are put to use and income variability of the enterprises is reduced. This means the farmer should select enterprises in his cropping scheme with less income variability. Income variability for the enterprises would be lessened through diversification, if the following relationships among prices and yields of products were established. If the prices and/or incomes of the enterprises have correlation nearer to + 1, then such enterprises should not be included in the

diversification process. If the correlation coefficient is negatively significant, then the two enterprises must be selected as the most suitable one to reduce the variability. The enterprises with zero correlation coefficient are the most suitable enterprises, for crop diversification. If their income variability and ranges are less such enterprises are selected in the cropping scheme.

Risk programming models and game theory models should be used to formulate whole farm plans under different risky situations. If enterprises are selected based on net returns over time in risky environment, the decision rule is to select the enterprises with their highest expected income. When the probabilities for the enterprises are not easily estimated, then assume equal probability for all the outcomes and the enterprise with highest expected income is selected. When the farming is subjected to high risky conditions, survival strategy should be adopted under such condition to select the enterprises with minimum net returns. Stable enterprises should be preferred rather than risky enterprises particularly in situation of farm risks.

2. Insurance

We have many types of insurances in farming to reduce production risk and financial risk. Crop insurance scheme reduces production risk. Livestock insurance provides safety against the fatal diseases of cattle. Farm assets are insured against theft, burglary, fire or any other damage. The decision whether to go for insurance or not is judged by the following equation.

$$\pi = F(0 - r) - P$$

Where,

π = Profit obtained by going for insurance.

F = Financial reserve required.

0 = Opportunity cost for financial resource in terms of %.

r = Interest earned on financial reserves.

P = Insurance premium paid by the farmer.

If $\pi > 0$, it is desirable for the farm to go for insurance i.e., the returns from the insurance policy are more than the cost and similarly, if $\pi < 0$, it is worthless to do insurance.

3. Agronomic Practices

To reduce production risk, crop rotations, suitable varieties, deep tillage, mulch-ing, etc., should be adopted.

4. Market Risk Management

If commodity prices are changing to a greater degree, then the price risk arising from market is more. Following are the methods proposed to reduce the marketing risk.

(i) Selling the Farm Products at Different Points of Time: Due to financial obligations, farmers sell their produce immediately after the harvest. During the harvesting periods generally prices will be low for commodities in the market due to large arrivals. Such sales at harvest period are said to be distress sales. If the farmers avoid such selling practices, they can get remunerative prices for their products. The knowledge regarding supply and demand for the farm products and prices

prevailing in different markets and other market information is essential. For perishable commodities, storage facilities, freezing facilities, processing facilities etc., are required to get remunerative prices. Hedging is another measure adopted by the farmers and the traders to safeguard against price-risk. Hedging practice is devised and followed by studying the future markets.

(ii) *Government Price Polices and Programmes*: Minimum support price, procurement price, levy price, issue price, *etc.*, are set for various agricultural commodities by the Government every year to bring about price stabilization. Support price provides protection for the farmers against fall in the prices of farm products.

5. Financial Risk Management

For reducing the financial risk we require many strategies, which are aimed at liquidity and solvency of the farm business. Solvency by definition refers to business ability to meet the long-term financial requirements of the farm. Liquidity strategies should aim at as to how to build up the farm business to meet the short-term cash requirements. At macro level fiscal policies formulated by RBI are aimed at to provide different measures to safeguard against the financial risk.