2. AGRONOMY

The word agronomy has been derived from the two Greek words, Agros and nomos having the meaning of field and to manage, respectively. Literally, agronomy means the "art of managing field". Technically, it means the "science and economics of crop production by management of farm land". Agronomy is the art and underlying science in production and improvement of field crops with the efficient use of soil fertility, water, labourer and other factors related to crop production. Agronomy is the field of study and practice of ways and means of production of food, feed and fibre crops. Agronomy is defined as "a branch of agricultural science which deals with principles and practices of field crop production and management of soil for higher productivity.

Importance

Among all the branches of agriculture, agronomy occupies a pivotal position and is regarded as the mother branch or primary branch. Like agriculture, agronomy is an integrated and applied aspect of different disciplines of pure sciences. Agronomy has three clear branches namely,

(i) Crop Science, (ii) Soil Science (iii) Environmental Science

That deals only with applied aspects. (i.e.) Soil-Crop-Environmental relationship. Agronomy is a synthesis of several disciplines like crop science, which includes plant breeding, crop physiology and biochemistry etc., and soil science, which includes soil fertilizers, manures etc., and environmental science which includes meteorology and crop ecology.

Basic Principles:

- Planning, programming and executing measures for maximum utilization of land, labourer, capital and other factors of production.
- Choice of crop varieties adaptable to the particular agro-climate, land situation, soil fertility, season and method of cultivation and befitting to the cropping system;
- Proper field management by tillage, preparing field channels and bunds for irrigation and drainage, checking soil erosion, leveling and adopting other suitable land improvement practices;
- Adoption of multiple cropping and also mixed or intercropping to ensure harvest even under adverse environmental conditions;
- Timely application of proper and balanced nutrients to the crop and improvement of soil fertility and productivity. Correction of ill-effects of soil reactions and conditions and increasing soil organic matter through the application of green manure, farm yard manure, organic wastes, bio-fertilizers and profitable recycling of organic wastes;
- Choice of quality seed or seed material and maintenance of requisite plant density per unit area with healthy and uniform seedlings;
- Proper water management with respect to crop, soil and environment through conservation and utilization of soil moisture as well as by utilizing water that is available in excess, and scheduling irrigation at critical stages of crop growth.

- Adoption of adequate, need-based, timely and exacting plant protection measures against weeds, insect-pests, pathogens, as well as climatic hazards and correction of deficiencies and disorders;
- Adoption of suitable and appropriate management practices including intercultural operations to get maximum benefit from inputs dearer and difficult to get, low-monetary and non monetary inputs;
- Adoption of suitable method and time of harvesting of crop to reduce field loss and to release land for succeeding crop(s) and efficient utilization of residual moisture, plant nutrients and other management practices;
- Adoption of suitable post-harvest technologies.
- Agronomy was recognized as a distinct branch of agricultural science only since about since about 1900.

Agronomist

"Scientist who studies the principles and practices of crop production and soil management for production of food for human beings and feed for his animals".

Role of Agronomist

- Generally agronomist studies the problems of crop production and develops better ways of producing food, feed and fibre.
- Agronomist aims at obtaining maximum production at minimum cost eg., developing efficient and economic field preparation method (i.e) energy should be minimized (i.e) what type of crop, in what season, etc.
- Agronomist shoulder the responsibilities of all social, economic, cultural problems in addition to field problems for the effective functioning of the farm in general.
- Agronomist exploits the knowledge developed by basic and allied, applied sciences for higher crop production.
- Agronomist carries out research on scientific cultivation of crops taking into account the effect of factors like soil, climate, crop varieties and adjust production techniques suitably depending on the situation.
- Since, the agronomist co-operates and co-ordinate with all the disciplines of agriculture, it is essential that an agronomist should have training in other disciplines of agriculture also.
- To develop efficient method of cultivation (whether broadcasting, nursery and transplantation or dibbling, etc.) The method may vary according to the germination period and depending upon the crop establishment and what should be the optimum plant population.
- He has to identify various types of nutrients required by crops, eg.,for long duration rice(150-100–50 kg), for pulses N, P and K. If the method of cultivation varies the nutrient content also varies. The time and method of applying nutrients must also be taken into account. Method refers to broadcast or to apply close to the root or through leaves (i.e.) foliage.
- Agronomist must select a better weed management practice. Either through mechanical or physical (by human work) or chemical (herbicides or weedicides, eg.; 2–4-D or cultural (by having wide space it may increase weed growth by using inter space crops). Weeds are controlled integrated means.

- Irrigation management: Whether to irrigate continuously or stop in between and how much water should be irrigated are calculated to find the water requirement.
- Crop planning (i.e.) developing crop sequence should be developed by agronomist (i.e.) what type of crop, cropping pattern, cropping sequence, etc.
- Agronomists are also developing the method of harvesting, time for harvesting, etc. The harvest should be done in the appropriate time.
- Decision-making in the farm management. What type of crop to be produced, how much crop, including marketing should be planned. Decision should be at appropriate time.

Classification of Crop Plants

Importance of classifying the Crop Plants

- To get acquainted with crops.
- To understand the requirement of soil & water different crops.
- To know adaptability of crops.
- To know the growing habit of crops.
- To understand climatic requirement of different crops.
- To know the economic produce of the crop plant & its use.
- To know the growing season of the crop
- Overall to know the actual condition required to the cultivation of plant.

Classification based on climate

Tropical : Crops grow well in warm & hot climate. Eg. Rice, sugarcane, Jowar etc

Temperate : Crops grow well in cool climate. Eg. Wheat, Oats, Gram, Potato etc.

Classification Based on growing season

Kharif/Rainy/Monsoon crops : The crops grown in monsoon months from June to Oct-Nov, Require warm, wet weather at major period of crop growth, also required short day length for flowering. Eg. Cotton, Rice, Jowar, bajara.

Rabi/winter/cold seasons crops : Require winter season to grow well from Oct to March month. Crops grow well in cold and dry weather. Require longer day length for flowering. Eg. Wheat, gram, sunflower etc.

Summer/Zaid crops : Crops grown in summer month from March to June require warm day weather for major growth period and longer day length for flowering. Eg. Groundnuts, Watermelon, Pumpkins, Gourds.

Use/Agronomic classification

Grain crops: May be cereals as millets cereals are the cultivated grasses grown for their edible starchy grains. The larger grain used as staple food is cereals. Eg. rice, Jowar, wheat, maize, barley, and millets are the small grained cereals which are of minor importance as food. Eg. Bajara.

Pulse/legume crops : Seeds of leguminous crops / plants used as food. On splitting they produced dal which is rich in protein. Eg. green gram, black gram, soybean, pea, cowpea etc.

Oil seeds crops : Crop seeds are rich in fatty acids, are used to extract vegetable oil to meet various requirements. Eg. Groundnut, Mustard, Sunflower, Sesamum, linseed etc.

Forage Crop : It refers to vegetative matter fresh as preserved utilized as food for animals. Crop cultivated & used for fickler, hay, silage. Ex- sorghum, elephant grass, guinea grass, berseem & other pulse bajara etc.

Fiber crops : Crown for fiber yield. Fiber may be obtained from seed. Eg. Cotton, steam, jute, Mesta, sun hemp, flax.

Roots crops : Roots are the economic produce in root crop. Eg. sweet potato, sugar beet, carrot, turnip etc.

Tuber crop : Crop whose edible portion is not a root but a short thickened underground stem. Eg. Potato, elephant, yam.

Sugar crops: The two important crops are sugarcane and sugar beet cultivated for production for sugar.

Starch crops : Grown for the production of starch. Eg. tapioca, potato, sweet potato.

Drug crop : Used for preparation for medicines. Eg. tobacco, mint, pyrethrum.

Spices & condiments/spices crops : Crop plants as their products are used to flavour taste and sometime colour the fresh preserved food. Eg. ginger, garlic, chili, cumin onion, coriander, cardamom, pepper, turmeric etc.

Vegetables crops : May be leafy as fruity vegetables. Eg. Palak, mentha, Brinjal, tomato.

Green manure crop : Grown and incorporated into soil to increase fertility of soil. Eg. sun hemp.

Medicinal & aromatic crops : Medicinal plants include cinchona, isabgol, Opium poppy, Senna, belladonna, rauvolfia, Licorice and aromatic plants such as lemon grass, citronella grass, palmorsa, Japanese mint, peppermint, rose geranicem, jasmine, henna etc.

Classification based on life of crops/duration of crops:

Seasonal crops : A crop completes its life cycle in one season-Karin, Rabi. summer. Eg. rice, Jowar, wheat etc.

Two seasonal crops : Crops complete its life in two seasons. Eg. Cotton, turmeric, ginger.

Annual crops : Crops require one full year to complete its life in cycle. Eg. sugarcane.

Biennial crops: Grows in one year and flowers, fructifies & perishes in the next year. Eg. Banana, Papaya.

Perennial crops : Crops live for several years. Eg. Fruit crops, mango, guava etc.

Classification based on cultural method/water:

Rain fed : crops grow only on rain water. Eg. Jowar, Bajara, Mung etc.

Irrigated crops : Crops grow with the help of irrigation water. Eg. Chili, sugarcane, Banana, papaya etc.

Classification based on root system

Tap root system : The main root goes deep into the soil. Eg. Tur, Grape, Cotton etc.

Adventitious/Fiber rooted : The crops whose roots are fibrous shallow & spreading into the soil. Eg. Cereal crops, wheat, rice etc.

Classification based on economic importance:

Cash crop : Grown for earning money. Eg. Sugarcane, cotton.

Food crops : Grown for raising food grains for the population and fodder for cattle. Eg. Jowar, wheat, rice etc.

Classification based on No. of cotyledons

Monocots or monocotyledons : Having one cotyledon in the seed. Eg. all cereals & Millets.

Dicots or dicotyledonous : Crops having two cotyledons in the seed. Eg. all legumes & pulses.

Classification based on photosynthesis (Reduction of CO_2/Dark reaction)

C3 Plants

Photorespiration is high in these plants C3 Plants have lower water use efficiency. The initial product of C assimilation in the three 'C' compounds. The enzyme involved in the primary carboxylation is ribulose-1,-Biophospate carboxylose. eg. Rice, soybeans, wheat, barley cottons, potato.

C4 plants

The primary product of C fixation is four Carbon compounds which may be malic acid or ascorbic acid. The enzymes responsible for carboxylation are phosphoenol Pyruvic acid carboxylose which has high affinity for CO_2 and capable of assimilation CO_2 even at lower concentration, photorespiration is negligible. Photosynthetic rates are higher in C4 than C3 plants for the same amount of stomatal opening. These are said to be drought resistant & they are able to grow better even under moisture stress. C4 plants translate photosynthates rapidly. eg. Sorghum, Maize, napter grass, sesame etc.

Cam plants

(Cassulacean acid metabolism plants) the stomata open at night and large amount of CO_2 is fixed as a malice acid which is stored in vacuoles. During day stomata are closed. There is no possibility of CO_2 entry. CO_2 which is stored as malic acid is broken down & released as CO_2. In these plants there is negligible transpiration. C4 & cam plant have high water use efficiency. These are highly drought resistant. eg. Pineapple, sisal & agave.

Classification based on length of photoperiod required for floral initiation:

Most plants are influenced by relative length of the day & night, especially for floral initiation, the effect on plant is known as photoperiodism depending on the length of photoperiod required for floral ignition, plants are classified as:

Short-day plants: Flower initiation takes place when days are short less then ten hours. Eg. rice, Jowar, green gram, black gram etc.

Long day plants: Require long days are more than ten hours for floral ignition. Eg. Wheat, Barley,