Chapter V.

Summary and Conclusions

Sorghum bicolor (L.) commonly known as jowar is one of the major cereal crops in India as well as all over the world. It is the most important food and fodder crop of dry land agriculture. The annual area under cultivation of sorghum in India ranger between 17-18 million hectares and annual production about 8-10 million tonnes. The sorghum is supplying nutrition to human being as well to the animals; which are giving us milk and meat. Sorghum is widely grown in North Central and South America, India, Pakistan, Africa U.S.S.R. and some part of Europe; U.S.A. being the largest producer in the world. It requires relatively shorter duration (about 120 - 125 days) for maturation. The crop can be grown in both the rabi and kharif seasons so it is helpful for increasing the yield of the crop. Secondly the sorghum requires very less amount of rainfall but it can also grow well under the soils of moderate irrigation or with low moisture requirements. Thirdly the jowar is cultivated in all types of soils. It can be grown in light soils as well as very fertile heavy soils. The sorghum gives good response with the application of different manuers and chemical fertilizers.

The new investigations in the improvement of different crops to obtain maximum yield are more useful in order to solve the burning problem of the food supply to the tremendous

population of the world. In the past 20 years a considerable progress has been made in Sorghum and Pearl millet to increase the yield of commercial use of hybrids and varieties; by incorporating resistance to diseases and pests. In fact more attention has been paid to major cereals like sorghum, wheat, rice, maize however, a very little attention has been paid to minor millets like proso millet, finger millet, oil seeds.

The physiological aspects of any plant species is giving the guide lines to agronomists, plant breeders plant pathologists to improve that perticular plant species to yield more production and possessing the characters like drought resistance, disease resistance and suitability for different environmental conditions and also for different soil types. However, a sufficient research is done on this crop but still it requires more investigations. To increase the drought resistivity of any plant is a success over the uneven rainfall. Hence in the present investigation drought resistance (water stress) of the plant is studied with respect to other physiological studies.

In the present investigation we have made an attempt to study the physiology of drought resistance in SPV-504 and RSV-10R varieties of Sorghum bicolor. Especially the different aspects like soil temperature, soil moisture percentage, chlorophyll contents of the leaves, stomatal behaviour, and inorganic consti-

tuents are studied under irrigated conditions as well as water stress conditions of these cultivars. As the soil temperature has a considerable influence on the water absorption by the plants, it is studied in water stressed plants. The low temperature reduces water absorption, because at lower temperature of the soil mobility of the soil water is reduced. Protoplasm is less permeable at low temperature and root growth is inhibited. But at sufficient or moderate temperature of the soil all process will be in proper way. Soil moisture percentage is important factor in drought conditions. So different soil types and their field capacity (moisture percentage) is recorded, for different stress conditions. The ability of the soil to retain more soil moisture percentage even under drought conditions is useful for growth of the crop plant.

The chlorophyll pigments of the plants are centers of absorption of photons of light rays (radient energy) and also these pigments are helpful in the synthesis of organic food substances (biological energy). So the study of effect of water stress on the chlorophyll content is essential. However, under sufficient clhorophyll content in the plant will definitely increase the yield and under insufficient chlorophyll content the yield will be reduced.

. The study on the effect of water stress on the stomatal

behaviour under irrigated conditions and under stressed conditions are helpful to know the daily periodicity of opening and closing mechanism of stomata. The opening and closing of stomatal aperture is directly depending upon the intensity of light, internal water relation in the leaves, and amount of temperature. Here an attempt is made to measure the width of stomata for every hour in a day. So for every hour the width of stomatal aperture is changed according to amount of light intensity and water deficit of leaves.

The inorganic constituents of a plant are playing very important and vital role in the physiological processes as well as the metabolism; these are studied in the mature leaves of the plant. Due to insufficient absorption of these inorganic constituents by any reason the plants are showing different deficiency symptoms. Some inorganic constituents may increase or some may decrease or still some may show increase upto certain days of water stress later period they decrease.

The significant findings of the present investigation can be listed as follows :

1. The hight of the plants subjected to water stress in both varieties SPV-504 and RSV-10R of sorghum go on decreasing as the period of water stress is increased.

2. The average growth of the plants under water stress in both varieties of sorghum (SPV-504 and RSV-10R) is reduced than the control plants.

3. The soil temperature in the earthen pots of both varieties is increasing as amount of water stress is increased. So soil temperature has a direct relationship with the water stress.

4. The soil moisture percentage of the soil in which the plants of two varieties are grown is decreasing as the amount of water stress is increased. So soil moisture percentage is universally proportional to the amount.

5. The chlorophyll content of the mature leaves in the SPV-504 and RSV-10R two varieties of sorghum is increased as the amount of water stress is increasing. The increase in chlorophylls due to stress may be an adaptive feature for drought resistance of these varieties.

6. The width of stomatal aperture goes on increasing from 7.00 a.m. in the morning to 1.00 p.m. The width of stomatal pore is maximum in all the plants between 12.00 noon to 1.00 p.m. in both SPV-504 and RSV-10R varieties. This may happen due to the rising of diffusive capacity of the stomata with increasing the light intensity from morning hours to

1.00 p.m. The width of stomatal aperture again decreases from 1.00 p.m. to 3.00 p.m. But it is observed that there is increase in the width of stomatal pore at 4.00 p.m. in both the cultivars. It is because of the resultant reduction in the diffusive capacity of stomata which permits an increase in the water content of the leaf and for a time the stomatal aperture again widen. Finally at the termination of day light period the width of stomatal aperture in both the varieties again go on decreasing. It is because of the decrease in the water deficit of leaves and low intensity of light.

7. It is noted that water stress has a marked effect on the mineral metabolism in both the varieties.

8. The potassium content in the leaves of both SPV-504 and RSV-10R varieties of sorghum increases upto 12 days water stress, but in 16 days stressed plants potassium decreases slightly. The accumulation of potassium upto 12 days water stressed jowar leaves may be for osmotic adjustments. The potassium content decreases after 12 days water stress may be due to exploitation of soil water due to drought.

9. The accumulation of calcium content in the leaves of SPV-504 and RSV-10R varieties of sorghum in the 4 and 8 days water stressed plants may be accounted for osmotic balance like potassium. However, this divalent cation declines due

to 12 and 16 days severe water stress. Like potassium, calcium may be involved in drought resistance mechanism.

10. The magnesium content in both the varieties of sorghum goes on decreasing as the period of water stress increases. Thus the decline of magnesium level in water stressed varieties of sorghum, may be an adaptive feature in drought resistance.

11. The sodium content in the leaves of both SPV-504 and RSV-10R varieties of sorghum goes on increasing slightly upto the 16 days water stressed plants. The accumulation of cation sodium in the leaves of water stressed SPV-504 and RSV-10R varieties of sorghum may contribute to osmotic balance which is an adaptive feature for drought.

12. The iron content of leaves in both SPV-504 and RSV-10R varieties of sorghum increases upto 8 days water stress and then declines towards 16 days water stress. This increasing iron content of the leaves in both the cultivars of jowar upto 8 days water stress may be due to the soil moisture stress. However, in 12 and 16 days water stressed plants there is a linear decrease in the iron level may attribute due to hindered up take of iron due to severe water stress.

13. In the leaves of SPV-504 and RSV-10R varieties of sorghum the level of manganese increases up to 8 days water

stress may be due to sudden shock of drought, the absorption of manganese is more on the other hand manganese content decreases towards 16 days water stress may be attributed to soil moisture stress.

From overall observations finally it is concluded that var. SPV-504 of sorghum is comparatively drought tolerant than sorghum var. RSV-10R.