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SOYBEAN SEED PHYSIOLOGY, QUALITY, AND CHEMICAL COMPOSITION UNDER SOIL MOISTURE DEFICIT STRESS

EXECUTIVE SUMMARY

An experiment was conducted at Mississippi State University utilizing sunlit environmental growth chambers. Seeds from MG V soybean cultivars Asgrow AG5332 (indeterminate type) and Progeny 5333RY (determinate type) were planted outside in pots that were filled with a 3:1 sand:top soil mix.

Five soil moisture deficit stress treatments included irrigation levels of 100, 80, 60, 40, and 20% of evapotranspiration (ET) values recorded on the previous day. Treatments were imposed 41 days after planting (DAP) and continued until harvest at 126 DAP. Initially, all plants were irrigated with the same water volume as in the 100% ET treatment until the time that each treatment was imposed at 41 DAP.

ET was measured on a ground area basis (L/day) throughout the treatment period as the rate at which condensate was removed by the cooling coils of the chambers at 900-s intervals by measuring the mass of water in collecting devices connected to a calibrated pressure transducer. Throughout the experimental period (from 41 to 126 DAP), soil moisture contents were monitored using soil moisture sensors inserted at a depth of 15 cm in five random pots of each soil moisture treatment. Season-long mean ET values for each treatment, mean values of day/night temperature, chamber CO_2 concentrations, and vapor pressure deficits (VPD) were recorded.

Plants were harvested 126 DAP, and leaves and all the plants were sampled for total dry weight (TD), number of seeds, and seed yield. About 25 g of seed from each cultivar of each treatment was ground and the ground material was analysed for protein, oil, fatty acids, sugar, and minerals.

Soil moisture deficit stress resulted in decreased seed number and weight of individual seeds, and this contributed to lower seed yield. There was also an increased number of shrivelled seed.

Protein, fatty acids, sucrose, N, and P in mature seed decreased with decreasing soil moisture, whereas oil and stachyose contents increased significantly.

Seed germination and vigor decreased proportionately with the decrease in weight of individual seeds and the changes in seed constituents. It is surmised that this may be due to lower storage reserves in the stressed seeds that will result in low seed vigor when these seeds are planted in the field.

These results suggest that maintaining optimum soil moisture for soybean during seedfill is essential to obtain both high seed yield and high-quality soybean seed at harvest.

These findings also suggest that maintaining optimum soil moisture content during soybean reproductive stages is important for the accumulation of enhanced levels of protein, sucrose, oleic acid, and macro nutrients, which are desirable traits for soybean seed that are used for processing soy products with high quality.