THE RELATIONSHIP BETWEEN SEED QUALITY, TIME OF RADICLE EMERGENCE, AND PLANT PERFORMANCE OF COTTON UNDER COMPETITIVE AND NON COMPETITIVE SITUATIONS

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Abstract

The plant performance of cotton as related to seed quality and time of radicle emergence was studied in competitive and non competitive plantings. Field tests were conducted at the Mississippi Agricultural and Forestry Experiment Station (MAFES) Plant Science Research Center, Mississippi State, Mississippi on a Marietta fine sandy loam. The cultivar examined was Deltapine 20. Seed quality and time of radicle emergence were characteristics which were evaluated for their effects on plant growth and reproductive characteristics in field test. One seed lot was obtained by hand harvesting bolls at carpel cracking. Harvested bolls were then dried and ginned on a small saw gin. Seed from this source were separated into four density fractions and the highest density fraction was retained for this study and labeled as the high (H) lot. Three other seed lots were from commercial seed obtain from the Delta and Pine Land Co., Scott, Mississippi. One of these lots was considered medium quality (M) and one lot low quality (L1) based on germination test and evaluations by the Delta and Pine Land quality control laboratory. A fourth category of seed was prepared for this study by placing approximately 10 kg of seed from the medium quality lot in a closed desiccator at 30°C - 75% relative humidity for 120 days. This lot was considered low two (L2). Lots ranged from 78 to 100% germination and varied in time of radicle emergence when seed were germinated in wet roiled germination towels. Beginning 24 hours after planting, seeds were removed from the towels if radicles had ruptured the seed coat. This procedure was repeated at 32, 40, and 48 hours after planting. Seedlings for the non competitive field planting were planted in a 50:50 mixture of screened field soil and potting soil in paper cups located in the greenhouse. These were later transferred to the field when plants were in the 2 to 4 leaf stage. Seedlings in the competitive planting were transferred directly from the germination towel into the field and hand planted approximately 2.5 cm deep, 10 cm apart in a 12 M long plot.

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The non competitive planting produced plants with growth habits dramatically different from those normally found in a field situation. Jenkins et al. (1990) reported the general fruiting pattern for Delta type cotton is to have about 3-d and 6-d vertical and horizontal fruiting intervals, respectively. Under good growing conditions plant usually have 20 to 24 vertical nodes produces during a growing season. The first sympodial branch usually occurs at node 5 to 7 and sympodia continue to arise at each vertical node for the remainder of the growing season. Thus a plant will produce about 16 to 18 sympodial branches with 2 to 5 fruiting positions each. From approximately 48 fruiting sites on the sympodial branches, one a few will produce a harvestable boll on any given plant. The plant also produces 1 to 2 monopodial branches at a plant density of 95,000 ha^{-1} that may bear fruit near mid-season.

Plant height differences during the growing season were not significantly different due to seed quality but were significantly different due to time of radicle emergence at 26, 47, and 54 days after transplanting. At maturity, however, plant height was not significantly different. Baskin et al. (1990) found plant height differences due to time of radicle emergence existed for several weeks but were not different after eight weeks of growth in a green-house study. This same phenomenon was observed in this study.

Plants produced an average 13 to 14 sympodial branches and 4 to 5 monopodial branches. Total bolls was extremely high for all treatments and ranged from 75 to 82 per treatment (plants). The percentage of total bolls in fruiting position one, two, three (position > 2, including axillary position) was as 15, 13, 24% respectively. Positions on monopodial branches accounted for 48% of the total number of bolls.

Kerby et al. (1987) reported that fruiting positions one, two, and three accounted for 58.1, 21,4, and 5.6% of the total lint produced by a plant and monopodial branches accounted for 14% of the total lint produced by a plant. Jenkins et al. (1990) reported that fruiting positions one, two, and three accounted for 71, 20, and 3% of the total lint produced by a plant and monopodial branches accounted for 6% of the total lint produced by a plant. In this study position one, two, and three accounted for 18, 13, and 23% of the total lint produced by a plant and monopodial branches accounted for 46% of the total lint produced by a plant. Mauney (1986) reported that about 80 of the total yield was produced at fruiting positions one and two on the sympodial branches. Jenkins et al. (1990) obtained 90% at fruiting positions one and two. In this study only 31% of the total yield was obtained at fruiting positions one and two, thus a dramatic difference in fruiting and yield patterns under non competitive planting.

Results of the competitive planting agree with findings of other investigators (Bishnoi, 1971; Bird and Reyes, 1967;

Popinigis, 1973; Assuncao, 1972; and Wanjura et al., 1969) . These investigators implicated that both plant development and yield decrease as seed vigor levels decreased and as time of emergence increased.

In the competitive planting, height differences were significant among seed quality early in the plant development stage but were inconsistent. Later in the growing season there were no height differences, height at maturity from plants of H, M and L1 seed quality was significantly greater than those from the L2 seed quality. Plants from the 24, 32, and 40 hour time of radicle emergences were significantly taller than those from the 48 hour time of radicle emergence.

Fruiting patterns in the competitive planting were more typical of those described by Jenkins et al. (1990). Plant produced on average 10,1 to 11.1 sympodial branches and 1.3 to 2.1 monopodial branches. Total bolls ranged from 9.4 to 11.6 per plant. Total bolls on the plants for the H seed quality level was significantly higher than total bolls from the L2 seed quality but was not different from the M and L1 produced significantly fewer bolls than the 24, 32, and 40 hour time of radicle emergence. Percentage of total bolls was distributed across fruiting positions as 55, 25, 7, and 13% for fruiting positions one, two, and three, and monopodial branches which is typical for plants in competition.

Seed cotton for positions one, two, and three accounted for 57, 24, and 7% of the total lint produced by a plant and monopodial branches accounted for 12% of the total lint produced by a plant. These fruiting patterns were very similar to those described by Jenkins et al (1990). Yield of plants from the H seed quality produced significantly more seed cotton yield than plants from the L2 seed quality. Plants from the 24 and 40 hour time of radicle emergence produced significantly more seed cotton yield than plants from the 48 hour time of radicle emergence.

Fruiting habits and yield differences in the competitive planting followed the trends expected. Yield was greater in plants from high quality seed and from the seed where radicle emergence was earlier, however, differences were not as pronounced as those reported by Wanjura et al. (1969a). One probable reason for not finding differences to be significant was the extreme variation in individual observations in both competitive and non competitive plantings as indicated by the high coefficient of variation in many instances. This study supports the hypotheses that early germination and plant emergence are indicative of the yield potential of the plant.

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