UPDATE ON VARIETY AND PRODUCTION TRENDS IMPACTING SEED SIZE

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Abstract

Cotton seed dimension, weight, density, and composition are naturally influenced by production environment, year, and location. Seed size, measured by seed index as weight in grams of 100 fuzzy seed, is a highly heritable trait. As such, variety selection impacts seed index, and seed index issues experienced downstream in any given year are impacted by variety market share. There were 129 cotton varieties available for producers to purchase in 2020, according to the seed cost calculator offered on Plains Cotton Growers website. Transgenic varieties with three modes of insect resistance (IR) and three modes of herbicide tolerance (HT) represented almost half, 49%, of available varieties. Emergence of resistance in insect and weed species to transgenic modes of action are driving quick transition from two-mode IR transgenic varieties (37% in 2020). HT alone varieties, without transgenic IR, and varieties without any transgenes, represented 14% of available varieties in 2020. Selecting for six modes of action from transgenes in the variety development process reduces population size from which other traits, such as seed index can be selected. Progress in molecular and genomic selection strategies has improved resistance to diseases with near qualitative inheritance and can be used to raise probabilities for other heritable traits such as seed index. Cross-discipline communication and National Cotton Council establishing Seed Quality Committee in 2019 helped put seed index trait and its importance to downstream processing, not just production issues such as stand establishment, 'on the radar.' According to USDA-AMS 'Cotton Varieties Planted' bulletin, relatively small-seeded DP 1646B2XF was planted on 22.25% US acres in 2019, and 21.35% in 2020. This variety is expected to be replaced by varieties that carry three modes of IR action, such as NG 5711B3XF, the second ranking variety in 2020 with 6.62% US market share, mostly in Georgia. Of 129 varieties offered in 2020, the 20 with highest US market share were planted on over 70% of acres. Thirteen of the top twenty market share varieties were the same in 2019 and 2020. Texas A&M AgriLife Research Lubbock commercial cotton variety trials included nine of the top 20 varieties in 2019 and 10 of the top 20 in 2020. Comparing those, seed index ranged from 8.6 to 11.9, with a mean of 10.1 under irrigation; and from 7.9 to 11.1 with a mean of 8.9 in rainfed conditions. Impact on seed size of disease or pests such as root-knot nematode and Verticillium wilt appear to be less, especially in new resistant varieties. Thirty-six new variety candidates and pre-commercial strains were tested in 2020 under irrigation at Texas A&M AgriLife Research and Extension Center in Lubbock. Experimental design was randomized complete block with four replications, planted in two-row plots nine meters long on one-meter centers. Seed index ranged from 8.6 to 11.7, with the highest and lowest seed index entries coming from the same company. The top ten new strains in terms of yield had seed index ranging from 9.0 to 10.6, with a mean of 9.8, shattering the myth that small seed is necessary for high yield. The overall range of seed index in potential new varieties and current top market share varieties tested in 2020 under irrigation in Lubbock was almost identical. These trends indicate shift in varieties planted is driven mostly by transgenic IR and HT traits. Progress in molecular and genomic breeding tools, as indicated by significant improvement for native gene pest resistance in new varieties, shows promise for improving heritable traits such as seed index. Declining water availability, especially in large acreage of the Southern High Plains, needs to be considered in breeding for seed properties just as it is considered for fiber property improvement. Communication among breeders, seed variety companies, ginners, cottonseed processors and brokers has been key to elevating seed size issues.