Quality and yields in the Mediterranean countries

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During the ginning conference at the recent Beltwide Cotton Production Research Conferences in the United States, there was a panel discussion by textile mill representatives on what quality factors are most important to the textile mills. Textile manufacturers emphasize that strength, length, uniformity, maturity, neps and short fiber are of greatest importance but the premiums and discounts on the price of cotton are based on grades. Within limits, compromises can be made between grade and other fiber properties during ginning. There are no more than compromises since lint cleaning will reduce the foreign matter content and thus improve grades but in so doing the short fiber and nep levels will be increased.

In 1984 Mr. Geoff Woodhead of Courtaulds Limited in England presented a paper at the ICAC seminar in Arusha in which he pointed out that over the past twenty years there has been a progressive increase in the short fiber content of cotton, notably from the United States. This phenomenon could be related to the progressive increase in mechanical harvesting during that period with the associated increase in the use of lint cleaners in order to achieve satisfactory grades. At this year's Beltwide Conferences, during a session on neps, Mr. W. Naarding formally of the IIC and now at the Institute of Textile Technology in Charlotesville, Virginia, spoke of an increase in seed coat fragments in cotton lint. These are very small fragments which are attached to a tuft of fiber making their removal by cleaners either in the ginnery or spinning mills extremely difficult. They are spun into the yarn and appear as small black specks in knitted or woven fabrics which interfere with the uptake of dye, leaving small, white, undyed spots under the fragment. Another paper discussed differences in fiber maturity in bolls at different fruiting positions on the plant. This paper showed that bolls on the lower fruiting branches and in the fruiting positions closest to the stem produce lint with a higher maturity than those further out on the fruiting branches and further up the main stem. This is not necessarily new information but it is very relevant when viewed in relation to the problem of increased short fiber and increased seed coat fragment.

This paper attempts to relate the problems of increased short fiber and increased seed coat fragments to the main topics of the seminar, notably earliness and mechanization. It is not intended to provide answers but rather to ask questions in order to stimulate discussion and possible new lines of research.

Fiber and seed maturity

At the Beltwide Conferences in 1966 Dr. Tom Kerr discussed the components of yield and quality. He pointed out that mean fiber weigh is made up of fiber perimeter and maturity and is a component of both yield and quality. Thus, any drop in the maturity of cotton will lead to a drop in yield and micronaire. This in turn will lead to an increase in the development of neps during ginning.

The paper on boll position and maturity presented at the Beltwide Conference in Las Vegas was a remainder that later bolls are less matured when they open than early bolls. This applies equally to

the seed and the fiber. Dr. Bozhinov and Dr. Dimitrova of Bulgaria reported on work being done at the Regional Meeting in Athens in 1984. There has also been a move towards once over harvesting with the use of this type of chemical in the USA. This would tend to increase the variability in the seed cotton with regard to maturity and one would expect that the less mature fibers and seeds would be more likely to break during ginning. This raises the question as to whether there is a relationship between once over harvesting and the use of chemicals to terminate flowering on the one hand and the increase reported in short fibers and the seed coat fragments on the other.

Breeding for early maturity

In most countries where cotton is grown, efforts are being made to breed earlier maturing, more determinate cotton varieties. In countries such as Bulgaria and the Soviet Union, these breeding programs extend back over many years and the objective has been to develop varieties which can be grown in a season which is restricted by temperature. In many other countries the main objective is to breed varieties which can escape late season insect attacks or to facilitate the production of a food crop and a cotton crop in one year.

In Australia, Mr. Alister Low conducted a breeding program on early maturing varieties for the southern part of New South Wales at a latitude of about 37° south over a period of some nine years. Under those conditions, the varieties which he developed were able to compete very favorably with American varieties such as Deltapine 16 but once they were moved away from an area where cool conditions were limiting in the early part of the season, they lost their advantage and could no longer compete. The variety Tamcot SP37 was introdued to the Narrabri research station in New South Wales in the mid 70's. In Narrabri, cotton is normally planted in early October and conditions during the early part of the season are generally cool. Tamcot SP37 was able to flower and produce a crop well in advance of Deltapine 16. However, when Tamcot is moved to the tropical areas, this advantage disappears. The main difference between early and standard varieties in these cases appears to be the ability to come into flower in fewer degree days.

Godoy and Niles presented two papers on a genetic analysis of earliness in upland cotton at the Beltwide Conferences in New Orleans in 1985. The first concerned morphological and phenological variables based on a dialell analysis involving seven early maturing parents of diverse origin and standard cultivar. The second paper concerned yield and fiber properties.

In the first study the correlation analysis showed that generally the lower node of the first fruiting branch and the shorter the plant, the earlier was the onset of squaring, flowering and boll opening. They concluded from this study that plant height, days to first flower and days to first open boll would be good criteria for selection of individual plants for early maturity since these traits have the highest heritability estimates and generally show significant and desirable associations with the other components of earliness examined in the study. The second study showed that the highest yields were achieved by the last determinate and the slowest maturing gene types. Yields generally decrease as determinacy increases and rate of maturity accelerated. Early, rapid fruiting and maturity were associated with reductions of fiber length, lenght uniformity, micronaire, strength and elongation.

In a paper presented at the ICAC seminar in Sydney Dr. Thomson referred to the emphasis that is being put into developing short season varieties not only to fit into shorter season environments but to reduce the time available for insect damage. He pointed out that as yield, quality and disease resistance is raised to levels competitive with full season varieties, there is a concomitant erosion of earliness. However, he did report that they expect to retain around a week of two in earliness in commercially acceptable short season lines which are undergoing preliminary testing.

The question is then raised as to how far cotton is physiologically capable of producing high yields of cotton with a satisfactory maturity in a short season. In Zimbabwe varieties such as Albar are fairly indeterminate and show a high level of stability for fiber maturity over seasons and locations. On the other hand, the more determinate Deltapine varieties tend to have far greater variability in fiber maturity and hence in micronaire from season to season and between locations in the same season. This suggests that there could be a physiological barrier as the number of fibers being matured at any one time

increases, the maturity decreases because of limitations in available photosynthate.

Mechanical harvesting

In 1984 Dr. Bozhinov and Dr. Dimitrova pointed out that in Bulgaria the plant population is such that only four or five bolls are needed per plant to provide satisfactory yield levels. In the United States a great deal of progress has been made with 30 inch row cotton while in Greece in 1984 we were shown some very good examples of twin row cropping. In these instances, the lower yield potential of smaller, earlier maturing varieties could be compensated for by increasing the plant population through narrower rows or through twin rows planting.

In 1984, Sappenfield et al reported on the results of trials comparing conventional early planted 30 inch row cotton harvested conventionally in October with short season delayed planting at 30 inch rows with once over October harvesting. The 30 inch rows gave higher yields than 38 inch rows with the highest yields coming from the late planting at 30 inch row spacing. However, this also gave the lowest micronaire value. The 30 inch rows in this trial were harvested with a brush stripper but the authors reported that spindle pickers were being converted and adapted to 30 inch rows and they felt that this, coupled with short season cultivars planted in warm soils using growth regulators and irrigation could permit refinements in a new and more profitable system for production of cotton in the northern Mississippi Delta.

In 1985, Valco *et al.* reported that in the Rio Grande Valley of Texas, 30 inch rows were compared with conventional 40 inch row cotton and that the average lint yields per acre were increased by 12 percent at the close spacing. These trials were hervested with a modified picker. These modified pickers are set at 60 inches between picking heads so that they can straddle one row while picking two taking the middle row on the return run. In this trial, the micronaire and staple length were equivalent in 30 inch and 40 inch row cotton but the 30 inch cotton gave a better grade. Increases in harvesting costs due to a reduction in the field capacity of the picker and the modification costs were offset by the increased returns from cotton yields.

At the same meeting Weir *et al.* reported on a trial in which comparisons were made between cotton treated with and without Pix in 30 inch rows. A reduction in plant height was measured in PIX treated plots at every location and in all cases, the treatment resulted in a yield increase. This report did not deal with fiber characteristics.

The results of these trials suggest that at narrower row spacings, a degree of earliness is achieved and yields are increased. This could compensate for any yield reduction in short season cottons. The increase in the number of rows could be achieved either through narrower overall row spacing, using a modified spindle picker. However, an economic evaluation will be necessary to determine if there is any difference in the grade of cotton produced using these two systems. The higher grade achieved in Texas suggests that these production techniques give cleaner seedcotton, resulting in higher grades. This would aid ginners in achieving satisfactory grades with minimum damage to the cotton.

Conclusions

The textile industry is showing justifiable concern over the increase in short fibers, neps and seed coat fragments in cotton from some areas. This increase may be associated with the trend towards once over harvesting and the use of chemicals to terminate flowering and force boll opening.

For various reasons, most plant breeding programs are concerned with the development of early maturing varieties. However, these efforts could be frustrated by relationships between lower maturity, lower yields and earliness. The same ends may be achieved without loss of yield or earliness through the development of early maturity production practices.

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