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NAWF CURVE AS AN OPTION FOR VARIETAL EARLINESS ESTIMATION IN UPLAND COTTON

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Introduction

Earliness is an important improvement criterion for the breeder. In cotton breeding, the specialist can still avail of a large range of methods to determine varietal earliness. Munro (1987) mentioned the most applied methods in English-speaking countries : the position of the first fruiting branch (NFB) and the date of first flower which depends on temperature, water supply and NFB. In French-speaking Africa and South American countries, breeders usualy define earliness by means of the "yield earliness", which is the ratio of the first to the total harvesting. Generaly all these methods are time-consuming jobs and need continuous monitoring to determine the right date to start the data observations. The recent development of cotton plant mapping (Landivar *et al.* 1993), (Burland *et al* 1997) gives a new alternative using the NAWF survey during the fruiting cycle until cutout (NAWF = 4) or final stage (NAWF = 0). The objective of this study was to find a useful and easy way to estimate the varietal earliness with a minimum survey.

Materials and methods

Five variety field trials were conducted within a two year period in the cotton region of Santa - Cruz - Bolivia. The study used local and imported varieties that gave a wide range of earliness types : very early varieties (Stoneville 132, Sure Grow 404), medium varietal earliness (CCA - 331, S.P. INTA) and late-long fruiting cycle varieties (CCA-222, Linea C534). In a first stage analysis, the study was carried out without repetition blocks. From the probable date of first flower, the NAWF was surveyed on ten plants per plot every week until the end of the fruiting cycle. In every trial , the means per plot were reported on a graph that showed the evolution of variety NAWF on a time scale (Fig.1). In most of the cases, the curves were zigzag-shaped and quite difficult to interpret. For a better interpretation, the use of linear regression (Dagnelie 1977) was required to reduce the NAWF variations. Currently, the open bolls percentage related to total bolls (open bolls / open and green bolls) was taken into consideration in the plant mapping.
Also 130 days after planting, the first harvest (H1) was made to determine the yield earliness after the final harvest (Hf)= (H1)/(H1+Hf).

Results and discussion

In a given trial, the NAWF regression curve expressed as "a-b x" represented the capacity for a variety to stop its fruiting cycle (b) and its relative production potential (a) .
A slope with a high regression coefficient distinguished a plant type that rapidly reached the cutout or the time that NAWF = 0 (CROZAT et al. 1995). As shown in figure 2, the variety CCA-222 was later than Stoneville 132 when the others were mid-early. The Earliness Index (E.I.) was calculated from the regression coefficient according to the relation : E.I. = $-[b]^{-1}$. In this case, an early variety had a lower E.I. than a late one. In other words E.I. represented the varietal response to environmental conditions that influenced post-blooming stages of the plant. The earliness index value varied for one variety in relation to the environment. In 1998, Stoneville 132 was not so early than a year before and CCA-331 showed a particulary low E.I.(fig. 3). It is risky to compare the values of one variety tested in different trials. The comparisons must be done referring to one common check. In the case of statistical regrouping analyses, the deviates expressed as a percentage of the check can be used.
The "a" constant characterized the potential of production correlated with the maximum NAWF at the first bloom on first position site (P1). CROZAT et al. (1995) mentioned that the number of flower buds on P1 sites that were above the last flower on P1 site at the begining of the blooming was a good reference for the forecasting of the production potential. For varieties starting their blooming within the same time range, the "a" constant was proportional to the number of reproductive branches when the regression coefficient was inferior to 1 in absolute value (fig.4). When "b" >[1], the relation was inverse.
The relationship of the average percentage of open bolls to E.I. was satisfactory from 55 % open bolls and up (fig. 5).For lower ranges, the relationship was disrupted by late fresh growth and the estimation error of the yield earliness (H1/Hf) at this stage (fig. 6).

Conclusion

The EI method allows us to detect the very early and late varieties. E.I. falls exactly in with farmers'needs: it is a tool that takes into consideration the last fresh regrowth (increase of NAWF), harmful to mechanical harvesting and the short boll maturation period.
E.I. method, through the "a" coefficient, lets us know about the production potential of a variety at the beginning of the blooming but it does not take the "cultivation hitches"(like physiological and pest shedding) into consideration.
In practice, the NAWF is observed on 5 to 10 plants per plot 5 times, every 2 weeks throughout the blooming period.This method exempts the user from a daily monitoring or a strict choice of date to record data. The E.I. method is an easy tool for the breeder in the field, who goes round the regional variety test networks.

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List of figures

Figure 1. Evolution of NAWF
Advanced varieties -1997

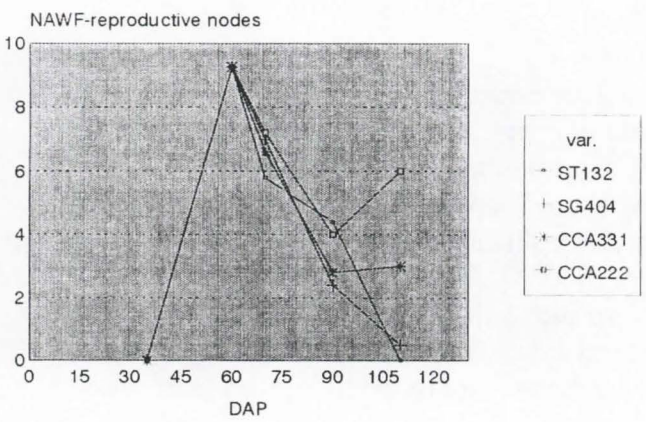


Figure 2. Estimation of earliness
Advanced varieties 1997

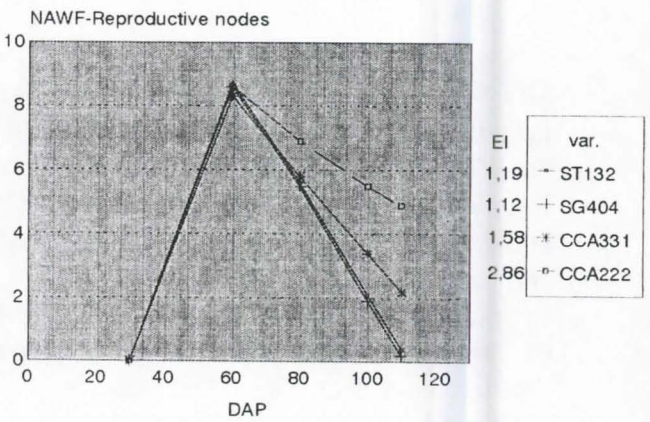
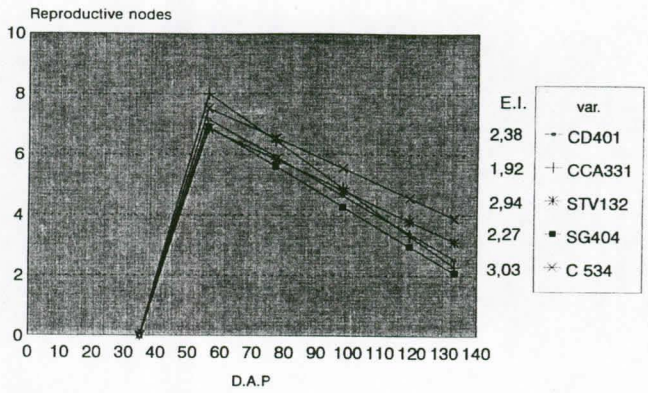
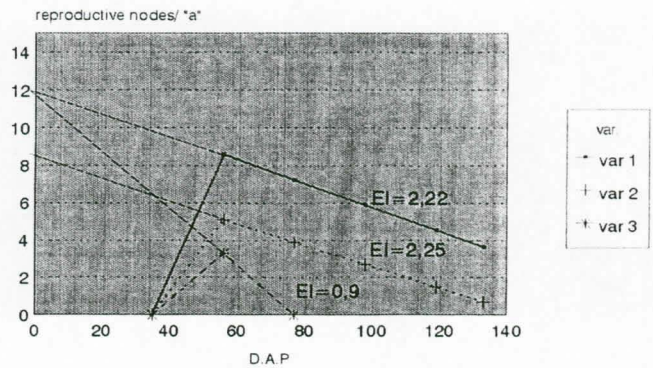


Figure 3. Evolution of NAWF and estimation of E.I.



year 1998

Figure 4. Evolution of NAWF and yield potential estimation
3 cases of interpretation



Simulation

Figure 5. Relationship of EI to boll opening percentage.
Levels up to 55 %

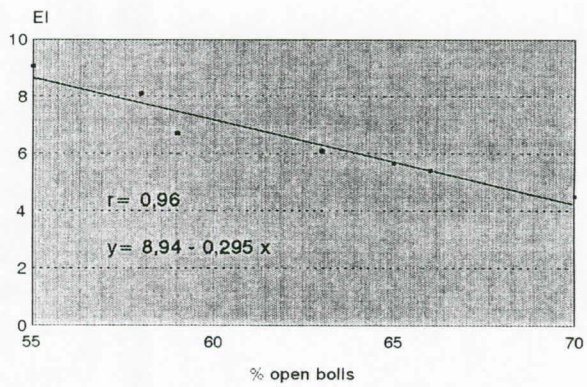


Figure 6. Relationship of EI to boll opening percentage.
Lowest levels (< 50 %)