Explanations for Yield Improvement in New Vs. Old Soybean Cultivars

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ABSTRACT

Reasons for the gradual genetic yield improvement (21-31 kg ha^{-1}yr^{-1}) for soybean during decades of cultivar development are not clearly understood. Identification of causative factors for the yield improvement would aid in providing indirect selection criteria for streamlining cultivar development. Our objective was to identify yield components, growth parameters, phenological data, and/or other agronomic data responsible for yield improvement in 18 cultivars released between 1952 and 2000. Results indicated that yield improvement was related more to increased dry matter accumulation than to greater Harvest Index. Yield enhancement in new vs. old cultivars was mainly related to greater seed, pod, and node numbers per area.

INTRODUCTION

❖Genetic gain of soybean shown to be 10 to 30 kg\ha\year (Specht et al.,1999,Boema,1979).
❖Increased yield resulted from greater total dry matter (Kumudini et al,2001) or Harvest Index (Gay et al,1980).
❖Yield components shown to be responsible for increased yield in new vs. old cultivars have varied (seed number and seed per pod, De Bruin and Pedersen, 2009; pod number, Boerma ,1979; and seed size, Gay et al,1980).
❖Effects of other yield components have not been studied.

OBJECTIVE

Identification of yield and growth parameters responsible for yield improvement for old vs new soybean cultivars.

MATERIAL AND METHODS

Eighteen soybean cultivars released between 1952-2000 were planted in 2007 and 2008 at the Ben Hur Research Farm near Baton Rouge, LA. The experiment was a Randomized Complete Block Design with four replications.

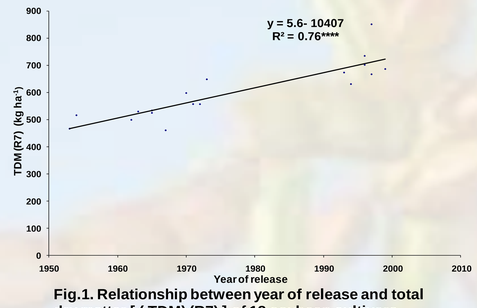

Fig.1. Relationship between year of release and total dry matter [(TDM) (R7)] of 18 soybean cultivars released between 1952 and 2000

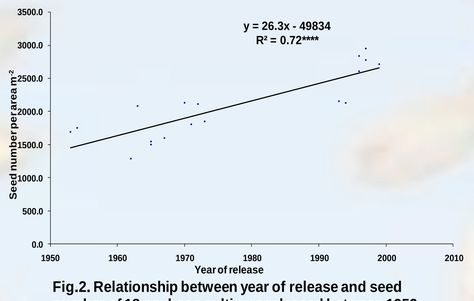

Fig.2. Relationship between year of release and seed number of 18 soybean cultivars released between 1952 and 2000

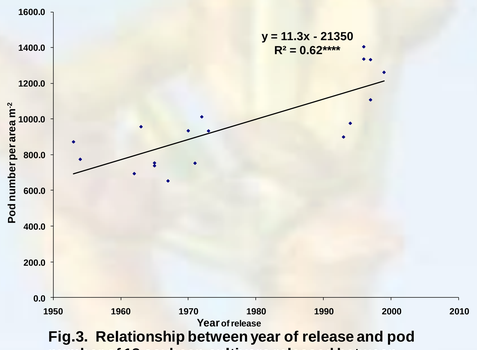

Fig.3. Relationship between year of release and pod number of 18 soybean cultivars released between 1952 and 2000

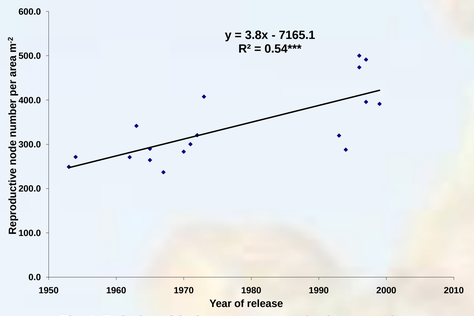

Fig.4. Relationship between year of release and reproductive node number of 18 soybean cultivars released between 1952 and 2000

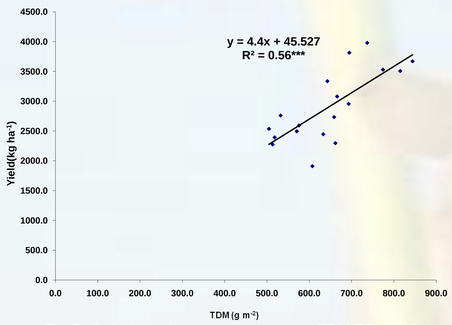

Fig.5. Relationship between yield and TDM(R7) of 18 soybean cultivars released between 1952 and 2000

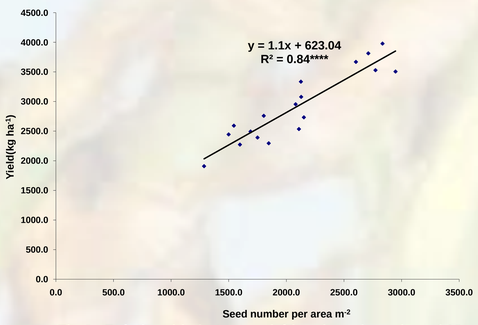

Fig.6. Relationship between yield and seed number of 18 soybean cultivars released between 1952-2000

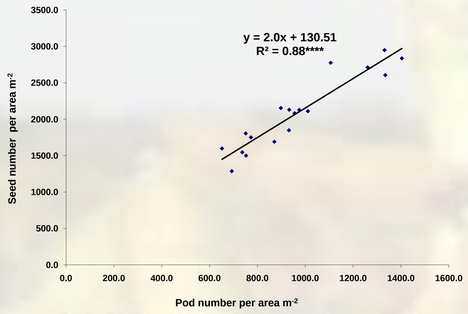

Fig.7. Relationship between pod number and seed number of 18 soybean cultivars released between 1952 and 2000

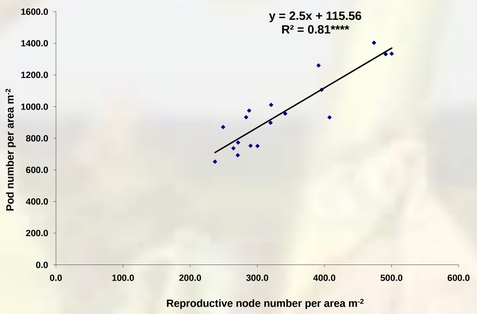

Fig.8. Relationship between pod number and reproductive node number of 18 soybean cultivars released between 1952 and 2000

Bragg (old cultivar)

TN5-95 (new cultivar)

Data were recorded on the following yield components and growth parameters: seed size, seed number per area, seed per pod, pod number per area, pod per reproductive number (reproductive node has at least 1 pod), reproductive node number per area, percent reproductive nodes (% of nodes becoming reproductive), node number per area, harvest index, total dry matter (TDM). Data were also taken on days to R5, R7, R5-R7, and lodging.

RESULT AND DISCUSSION

❖Factors that showed linear increases with year of release were: TDM (R^2=0.76), seed no. per area (R^2=0.72), pod no. per area (R^2=0.62) and reproductive node no. per area (R^2=0.54) (Figs. 1,2,3,4).
❖Among cultivars, similar parameters explained increased yield: TDM (R^2=0.56) (Fig. 5), seed no. per area (R^2=0.84) (Fig. 6), pod no. per area (R^2=.88) (Fig. 7), reproductive node no. per area (R^2=.81) (Fig. 8), and node no. per area (R^2=.89).
❖HI, seed size, seed per pod, pods per reproductive node, and percent reproductive node did not explain yield differences between cultivars in the study.
❖Across 1952-2000, yield increased 30.4 kg ha^{-1} year^{-1}.

CONCLUSION

Based on responses to year of release and analyses of yield differences between cultivars, results indicated that across the 1952-2000 period, soybean breeders have been inadvertently selecting for genotypes having greater TDM which produced greater node no. per area resulting in increased pod and seed no. per area.

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