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Summary

Improvement of Varieties of Soybean [Glycine max (L) Merrill] Through Adaptability, Breeding and Agronomic Investigations

This study covers three major aspects of soybean improvement in Malaysia. The first part was devoted to adaptability studies of introduced soybean cultivars emphasising the importance of genotype X environment interaction on the performance of these introduced soybean cultivars and highlighting the major plant characters correlated with seed yield either directly or indirectly through the use of path-coefficient analysis technique. The second part dealt with the use of nitrogen fertilisers to enhance yield. The last part concerned the use of induced mutation breeding technique to develop soybean lines which are suitable for cultivation under Malaysian climatic conditions.

Results of the first part of this study indicate that the cultivar X location X year variance component was relatively large compared with the genotypic variance component for traits: seed yield, branches per plant, nodes per plant, and pods per plant, suggesting that these traits could be improved through improved environment and management practices. On the other hand, the relatively large genotypic variance compared with small cultivar X location X year interaction variance component obtained in this study for traits: days to bloom, height at maturity, height at bloom, height at maturity and seed size, indicates that these traits could best be improved through an efficient breeding programme. Results of the path-coefficient analysis technique adopted in the first part of this study have yielded useful information. While simple correlation analysis technique revealed that seed yield of soybean was positively correlated with nodes per plant, pods per plant, and plant height at maturity, the path-coefficient analysis technique on the contrary, exposed that branches per plant and days to bloom were the two most important characters affecting yield of soybean. Though days to bloom had a negative direct influence on seed yield, it is positively correlated with branches per plant, more branches per plant would be developed as a result of longer days to bloom, thus resulting in an overall positive correlation with yield. In the absence of path-coefficient analysis, the causes for such correlation would not be identified. Hence, path-coefficient analysis was a useful tool to provide a better understanding of the genetic association between soybean characters, and that branches per plant and days to bloom have the greatest influence both directly and indirectly on the seed yield of soybean.

Results of the second part of this study indicate that under the acidic soil conditions prevailing in Malaysian soils, a positive response of soybean yield to nitrogen application was possible. The extra yield realised more than offset the nitrogen cost, indicating that applying nitrogen at as high a rate as 100 kg per hectare could still be an economical agronomic practice in soybean production in Malaysia, and that the optimal time

to apply nitrogen was during the initial bloom stage when requirement for nitrogen was at its maximum. The increase in seed yield could partly be attributed to the reduction of flower and pod abortion.

Results of the last part of this study show that it was possible to induce useful mutants in soybean through the use of induced mutation breeding technique. Among the mutant characters induced, except for seed coat colour and 'gigas' which retained their characters in subsequent generation testings, the other characters, earliness, lateness and seed size failed to do so.

The 'gigas' mutant which consistently out-yielded the control in subsequent generation testings by many-fold, has the best potential of being released as a high yielding soybean cultivar in Malaysia. This 'gigas' has a longer vegetative growth period and possesses more branches than the control. Since soybean yield has been shown in the first part of this study to be greatly influenced by the number of branches per plant, and the length of the vegetative growth period, this 'gigas' with increased number of branches and longer vegetative growth period would thus possess the ideal plant architecture for maximum yield production in the tropics in general and in Malaysia in particular where shorter day-length compared with the temperate zone, and small variation in day-length throughout the year are experienced.

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