Peanut Breeding-Global Prospects and Opportunities

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The national average yield of peanut among more than one hundred peanut growing countries ranges between 0.3 t ha^{-1} and 5.4 t ha^{-1}. The average world peanut yield is 1.4 t ha^{-1}. However, there are several documented cases in many countries where peanut yields in excess of 9.5 t ha^{-1} have been realized in farmers' fields. Such values can be considered as representative of the yield potential of peanut for the respective agroecological zones. There remains a large gap (> 5.0 t ha^{-1}) between yield potential and the yield realized at farmers' fields. This clearly suggests that the technology (non-genetic components) currently practiced by peanut farmers only realizes partial yield potential of the existing varieties. Under such circumstances, the breeding for further increase in yield potential in a peanut improvement program in developing countries, where peanut yields are generally low, is not advisable. Instead identification of barriers that limit realization of yield potential and their prioritization followed by resistance breeding for prioritized constraints should receive the most attention in national peanut breeding programs. In many cases, a non-genetic option may be an easier and profitable solution. The stress resistance breeding entails a price- some sacrifice in yield potential. However, as the gap between yield potential and realized yield is large, it should not matter at the current status of peanut cultivation in most of the countries. To keep the price of sacrifice in yield potential affordable, it will be essential to strike a proper balance between levels of resistance and yield potential. In most cases, a moderate level of resistance to stress factor(s) should suffice. However, for stresses that cause complete kill of the plant (e.g., many virus diseases), a high level of resistance or even immunity will be required. The stress resistance breeding will help to increase and stabilize realized yield under low input rainfed farming conditions where more than 80% peanut is grown. In addition, breeding for factors that affect the edible quality of produce including aflatoxin contamination will be essential to promote the edible use of peanut as the oil use of the crop is showing a declining trend across the world. Specialized peanuts for specific end-uses will required for better returns to peanut farmers. The two situations, where further increase in yield potential is justified, are i. where peanut is grown in stress free environment, ii. where a ceiling is reached in realized yield. Application of physiological models makes it possible to interpret genotype and environmental effects on yield, thus helps in assessing the scope for genetic improvement for a given trait. The breeding programs should be targeted to specific environments and so should be the evaluation system of breeding lines leading to local or regional variety releases.

Wild *Arachis* species are a reservoir of several useful genes. Their exploitation in peanut breeding programs remains limited. There is a need to invest resources in this area of research on long-term basis to mine useful genes and integrate them in superior agronomic backgrounds. Newly emerging biotechnology tools in peanut, genetic engineering and marker-assisted selection, offer opportunities to improve the crop more efficiently and effectively.

SUMMARY
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