

THE STATUS OF BEAN BREEDING IN UGANDA

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Abstract

Field beans *Phaseolus vulgaris* are the most important legume crop in Uganda. It is the most important source of protein and from a major component of the diet of many Ugandans. Over 400,000 hectares are grown annually in the country by small-scale producers and generally few inputs are used. However, production per unit area is low and vary between 400 to 700 kg/ha. The low yields are mainly attributed to biotic and abiotic constraints. Diseases such as common bacterial blight *Xanthomonas campestris* pv. *phaseoli*, Bean common mosaic virus, rust *Uromyces appendiculatus*, angular leaf spot *Phaeoisariopsis griseola* and floury leaf spot are widespread and can decrease yields considerably.

Breeding for resistance is the most important and economic approach (in the long term) for the farmer. In Uganda, the National beans breeding programme is involved with an intensive efforts to improve resistance to the most serious disease of beans with more emphasis on durable resistance. This report summarizes the breeding activities carried out on beans in Uganda since 1985. Future plans and breeding strategies are presented.

Introduction

Beans is the most important legume crop in Uganda. The crop is grown throughout the country and can be grown throughout the year. About 400.000 hectares of beans are grown annually and this figure is exceeded only by that of staple foods like cassava, maize and millet (Sengooba 1987).

Beans is a cheap source of protein and thus an important component in the diet of many Ugandans. The beans are consumed in fresh or in dry form. In some areas, the leaves are used as a green vegetable. Beans are also important for the internal and export market. It is one of the crops being encouraged as a non-traditional export crop by the Uganda government. This crop is one of the few crops which a woman can grow and be allowed to market and get cash from i.e. at household level. The other crops like coffee and bananas are mainly marketed by men.

Bean ranks very high as a priority crop. The crop is mainly produced by small scale farmers. The women groups are targeting beans as one of the crops to be produced on a large scale.

The beans have been cultivated in Uganda for a century and records indicate that the cultivated area has increased over tenfold (Ministry of Agriculture, Animal Industry and Fisheries (production zones and target areas), report, 1992). This increase in bean cultivation has unfortunately not been complimented by increases in yield as average outputs are stagnant at around 600 kg per ha. This low yield is attributed to several factors including: Pests and diseases, low yielding varieties, lack of appropriate

agronomic practices, poor soils and socio-economic factors that hinder adoption of new varieties.

The prime objective of the Uganda National Bean Programme is to increase the production of the crop by increasing productivity per unit area. Research efforts are therefore directed to producing high yielding cultivars with resistance or tolerance to the major diseases and pests, and which are well adapted to different ecological zones.

Major bean diseases

The major diseases of bean are: Common bacterial blight (CBB) *Xanthomonas campestris* pv. *phaseoli*, angular leaf spot (ALS) *Phaeoisariopsis griseola* sacc., Bean common mosaic virus (BCMV), rust *Uromyces appendiculatus* pers, floury leaf spot *Mycosphaerella phaseoli*. These five occur widely in the country but are most severe in the low altitude areas. Halo blight *Pseudomonas phaseolicola* Burk Dows, ascochyta blight *Phoma exigua* var *diversispora* and anthracnose *Colletorichum lindemuthiarum* are particularly destructive in highland areas of the country.

Yield loss assessment has been done for a few disease such CBB, BCMV and floury leaf spot. For these diseases the losses as determined in Uganda, ranges between insignificant (for resistant varieties) to 65 % in susceptible varieties (Opio, 1992, 1993, Sengooba 1991). For the other diseases the exact loss assessment has not been done but in bad seasons diseases like ALS and rust are very prevalent. Actually ALS is the most prevalent disease in Uganda (Sengooba, 1987). Anthracnose, ascochyta and halo blight sometimes result in total loss of the bean crop in the highland areas.

Current breeding programme

The main objective of the breeding programme is to identify new genotypes with superior yield, improved multiple disease resistance and with acceptable characters to both consumers and growers.

Varieties which are developed within the breeding sequence should have resistance to all or some of the major diseases as diseases are a major factor in reduction in yield.

Farmers lack fertilizers and other chemical inputs so tolerance to low soil fertility and disease resistance are taken into account. The variability in ecological zones necessitates multilocation testing of advanced lines to identify genotypes suitable for all sites or for specific sites in the country.

Sources of resistance are generally identified from the breeding lines received for screening or specifically requested from other programmes. Introductions are screened at the base site of the programme and observed for adaption and reaction to the major diseases. Most of the germplasm screened originates from the CIAT breeding nursery (VEF), though a few come from other collaborating countries. Segregating populations from CIAT and those generated locally specifically for yield improvement and disease resistance are also evaluated initially at the base site. Selections are made within the nurseries and populations for advancement through the breeding sequence of preliminary

(PYT), intermediate (IYT) and advanced (AYT) yield trials with progressively fewer lines tested at an increasing number of sites. The number of testing sites vary from 2-3 for the PYT, 3-4 for IYT and 5-8 for AYT. Selections are undertaken at each stage based mainly on seed yield and disease resistance.

On-farm variety testing is done on varieties selected from IYT and AYT with the aim of monitoring the response of farmers to the elite lines and identify weaknesses in these lines as well as disseminate new varieties.

There has been specific breeding programmes for resistance to common bacterial blight, *Ascochyta* blight and BCMV. The breeding programme on common bacterial blight (CBB) has utilized sources of resistance such as XAN 159, IAPAR 14, IAPAR 16, BAC 5, BAC 6, GN Jules and PI 207262, (Musaana et al,1992), while for *Ascochyta* blight G 10747, G 4603, BAT 1569 and BAT 1416 have been utilized as resistance sources (Sengooba et al, 1990). The breeding work on BCMV resistance is to utilize the bc2 and bc3 genes from CIAT breeding lines to avoid the black root problem. The programme has concentrated mainly on evaluation of populations received from CIAT for BCMV resistance. Resistance is incorporated into acceptable, elite varieties which are susceptible to these diseases.

Durable resistance has in the past not had direct emphasis but variety K20 released in 1968 has maintained its resistance to anthracnose. CBB breeding has also emphasized durable resistance. Durable resistance is however, desirable for a major disease such as angular leaf spot, CBB and BCMV which consistently occur across seasons and significantly reduces yield especially in the large seeded types where resistance is low. Monitoring of the durability of resistance to the common disease such as rust, ALS, *Ascochyta* blight etc. has been undertaken as the resistance status of the commonly used varieties was not specifically documented. For CBB monitoring is being done. The emphasis in future is bean breeding is directed towards durable resistance to the major disease.

Constraints

1. Beans are susceptible to a multiple number of diseases and the characteristics desired by the consumers/farmers are diverse. Combination of all desired resistance, phenotypic characters and yield is a commendable task and compromise has to be reached. With emphasis on increased yield, the better yielders are small seeded or of growth habit Type III (i.e. semi-climbers) which many farmers don't like.
2. The identification of high yielding genotypes (a qualitatively inherited trait) required testing of large numbers of genotypes at multilocations and usually financial resources limit the amount of work and sites that can be accommodated.
3. Large seeded types of growth habit Type 1 and Type 11 have limitations in yield and popularizing other growth habits e.g. climbers need be undertaken though staking material availability is a problem.
4. Many of the introductions from CIAT with high yield have 1-gene which leads to black root problem in field trials. The use of these lines in further crosses or their deployment for release is therefore hindered as a lengthy backcross programme involving recessive genes has to be undertaken first.

Conclusion

I would like to emphasize the fact that beans is a very important crop in Uganda. Durable resistance would be the answer to the different disease problems that are encountered in this country.

References

- Anon, 1992. Ministry of Agriculture Animal Industry and Fisheries. Production zones and targets, 1992-1995.
- Musaana, S.M., Musittala G and Kizito F, 1992. Breeding for resistance to common bacterial blight. In Uganda National Beans Programme Annual Report (compiled by Musaana, M.S.) Kawanda Research Institute Ministry of Agriculture, Animal Industry and Fisheries.
- Opio, A.F., Teri, J.M. and Allen D.J, 1992. Assessment of yield losses caused by common bacterial blight of beans in Uganda. Annual Report of Beans Improvement Co-operative 35, 2-3.
- Opio, A.F, 1993. Studies in pathogenicity, seed transmission and survival of *Xanthomonas campestris* pv. *phaseoli* in Uganda. Ph.D thesis, Sokoine University of Agriculture, Morogoro, Tanzania, 1993.
- Sengooba, T.N., 1987. Profile of the bean research programme and its impact on bean production in Uganda. In: proceedings of a workshop on bean research in Eastern African, Mukono, 8 and 1 Edited by R. Kirkby, CIAT African workshop series No. 2, 8-14.
- Sengooba, T., 1991. Studies on bean common mosaic virus in Uganda National Bean Programme Annual Report (compiled by M.S. Musaana) Kawanda Research Institute, Ministry of Agriculture, Animal Industry and Fisheries; 139-160.
- Sengooba, T. and B.S. Male Kayiwa , 1990. Progress in studies of Phoma blight of common bean in Eastern Africa. In: J.B. Smithson (Ed.). Proceedings of the second workshop on Bean Research in Eastern Africa CIAT series No. 7, 3-42.