

The Release and Registration of Gute (Late Set) Soybean Varieties

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Abstract

Gute is the name given to soybean [*Glycine max* (L.) Merr.] variety with pedigree of PM 12-3, brought from Jimma Agricultural Research Center. *Gute* variety was evaluated against the check and other genotypes for seed yield, agronomic characters and disease reaction at Bako, Billo Boshe and Gute experimental sites from 2016/2017 to 2017/2018. *Gute* variety was verified for possible release in 2019 at on farm and on station across all locations listed above. *Gute* gave seed yield of 2779.1 kg ha⁻¹, 39.4% protein content and 22.3% oil content respectively. The result of multi-environment yield trials showed that *Gute* (PM 12-3) outperformed the standard check (PRAC-3) by 20.1 % in seed yield and comparable in oil content. It was resistant to bacterial blight and bacterial pustule. Stability analysis showed that the variety was relatively stable in grain yield performance across locations than the check variety PARC-3. Therefore, *Gute* was released in 2020 for its high grain yield potential, disease tolerance and farmers preferences, and recommended for wider production in the test environments and similar agro-ecologies

Keywords: Commercial Variety, Pedigree, Soybean, Stability

Introduction

Soybean [*Glycine max* (L.) Merr.] is a legume native to East Asia perhaps in North and Central China (Laswai *et al.*, 2005) and it is grown for edible bean, oil and protein around the world. Soybean is found in family *Fabaceae* and species *G. max* (Shurtleff and Aoyagi, 2007). Soybean is one of the most important oil grain legume crops in the world. In the International trade market, soybean ranks number one among the major oil crops with an average protein content of 40% on dry matter basis. It has the highest protein content of all field crops and is the

second only to groundnut in terms of oil content (20%) among the food legumes. Dugje *et al.* (2009) reported that soybean is more protein rich than any of the common vegetable or legume food sources in Africa. Soybean is a promising pulse crop proposed for alleviation of acute shortage of protein and oil worldwide (Mahamood *et al.*, 2009). Soybean production begins only recently in Africa, during the second half of 20th century, is believed introduced to Ethiopia in the 1950's. Soybean research was started in the 1970's. Since then, 25 soybean varieties have been released in Ethiopia. Soybean

was the leading oil crop next to palm with over 250 million metric ton production in 2013 (FAO, 2014). It is rich sources of protein (38-46%) and oil (18-20%). Soybean containing 2.5 times the protein contents of wheat and four times the protein contents of maize. Soybean is classified in different groups such as early, medium and late maturing varieties. A variety is classified to a specific maturity groups according to the length of period from planting to maturity. This phenological attribute is determined by two abiotic factors: photoperiod and temperature (Mourtzinis and Conley, 2017), and these factors can dictate the most suitable maturity groups of soybean varieties for a particular geographical location. Therefore, development of new varieties under different maturity class of soybean varieties for specific agro-ecologies of western Oromia and similar agro-ecologies is a priority option to boost soybean production and productivities in the region.

Varietal origin and evaluation

Gute soybean [*Glycine max (L.) Merr.*] variety designated by pedigree of PM 12-3 was brought from Jimma Agricultural Research Center. This variety was evaluated against twelve other pipeline genotypes and the standard check at Bako, Billo Boshe and Gute experimental sites from 2016/2017 to 2017/2018.

Agronomic and morphological characteristics

Gute is characterized by round in seed shape, gray seed coat color and creamy seed coat luster. It is indeterminate and

has erected growth habit, which enable harvesting at the same time and prevent from pod rot during heavy rain fall. Gute has large seed size compared to the commercial variety, PARC-3 (Table 1). Their leaf size is large and more uniform and is suitable for intercropping with erected leaf type maize varieties. The mean data from three locations (Bako, Billo-Boshe and Gute) and for two years (2016/2017 and 2017/2018) revealed that Gute flowered in 74 days and matured in 141 days. Gute has better seed size, hundred seed weight and pod load than the check PARC-3 (Table 1).

Yield performance

Gute soybean variety was evaluated with standard check PARC-3, in multi-locations yield trials. Gute gave a seed yield ranging from 1.8 to 2.7 ton ha⁻¹ on research stations and 1.5 to 2.4 ton ha⁻¹ on farmers' fields (Table 1). Gute outperformed PARC-3 by 20 % and 14 % yield advantage on station and on-farm in seed yield, respectively.

Oil and protein content

About 22.3 % of oil content was recorded from Gute while was 22.6 % recorded from the commercial variety PARC-3. The laboratory result revealed that Gute had higher protein content and comparable oil content with PARC-3. However, the newly released Gute soybean variety had higher protein content (39.4 %) than the commercial variety PARC-3.

Table 1: Agronomic/morphological characteristics of Gute variety

Characteristics	Gute (PM-12-3)
Adaptation area	
Altitude m (a.s.l)	1650-1900
Rainfall (mm)	1000-1200
Fertilizer rate (NPS) kg ha ⁻²	100
Fertilizer application time	At sowing
Fertilizer application method	Side dressing & avoid seed contact
Planting and seeding	
Planting date	Mid-June
Seeding rate (kg ha ⁻¹)	60-70
Row spacing (cm)	60
Plant spacing (cm)	10
Weeding frequency	3-4
Days to flowering	74
Days to maturity	141
Number of pods plant ⁻¹	81
Number of seeds pod ⁻¹	3
Leaf size	Large
Growth habit	Indeterminate
Seed coat color	Light yellow
Seed coat luster	Dull
Helium color	White
Seed shape	Round
Seed size	Medium
100 seeds weight	20
Oil content (%)	24.35
Protein content	39.4
Crop pest reaction (1-9 scale)	
Bacterial blight	2.75
Bacterial pustule	2.75
Rust	2.5
Yield (ton ha ⁻¹)	
Research filed	1.8-2.7
Farmer field	1.5-2.4
Year of release	2020

Stability and Adaptability Performance

Genotype x environments interaction was partitioned into principal component axes and the first IPCA (69.28%) and the second IPCA (22.41%) explained the largest proportion (91.68 %) of the total

variation. The result of the study revealed that Gute (PM-12-3) is ideal and stable varieties compared to the commercial variety, PARC-3 (Figure 1). Gute was found to be a more stable new soybean variety and higher in oil content compared to the commercial variety PARC-3.

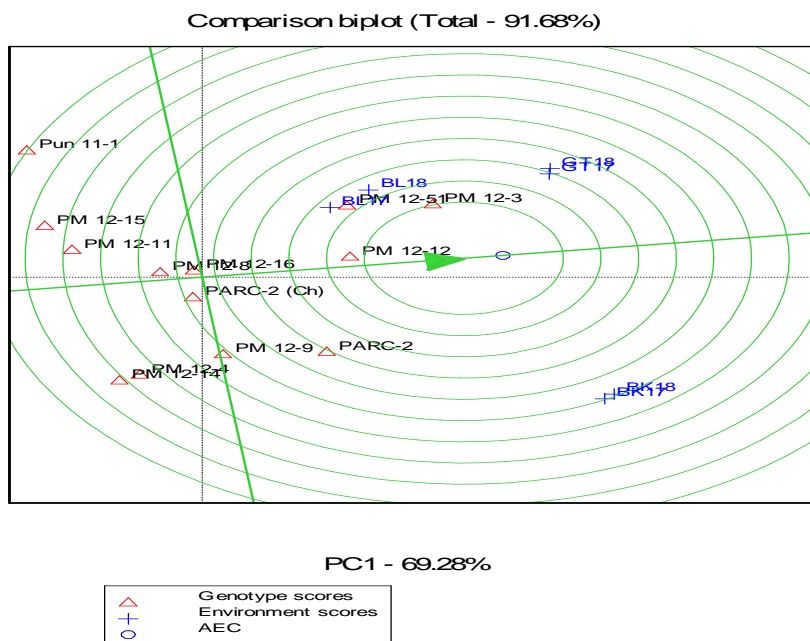


Figure 1: Ranking the genotypes relative to the ideal genotype.

Reaction to Major Diseases

The major soybean diseases in western Oromia such as bacterial blight, bacterial pustule and rust were recorded using 1-9 scale. Accordingly, Gute (PM-12-3) was resistant (< 3 severity score for the three major diseases recorded (Table 1).

Breeder Seed Maintenance

Breeder and foundation seed of the variety is maintained by Oromia Agricultural Research Institute Bako Agricultural Research Center.

Conclusion

The soybean variety Gute had higher seed yields, protein content,

comparable oil content and better stability performances than the commercial variety PARC-3. The variety was also resistant to common soybean diseases viz., bacterial blight, rust and bacterial pustule and hence, have been released for the test environments and areas with similar agro-ecologies.

Acknowledgement

We gratefully thank Agricultural Growth Program (AGP-II) of Oromia Agricultural Research Institute for financing the development of the variety. We also thank International Institute of Tropical Agriculture (IITA) and Jimma Agricultural Research Center for germplasm sharing. Our appreciation and thank extended to staff members of Bako

Agricultural Research Center for field work and data collection.

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