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# Evaluation of High Yielding Groundnut Varieties for North Transitional Zone of Karnataka State, India

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***Authors' contributions***

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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## ABSTRACT

Groundnut (*Arachishypogaea* L.) is an important oil seed crop grown in the arid andsemi-aridtropics of India under rainfed condition. The productivity is around 800 kg $ha^{-1}$ in Karnataka as against national productivity of 1500 kg $ha^{-1}$. The reasons for low productivity are many among them lack of improved variety in groundnut cultivation. Hence, study conducted to evaluate the high yielding groundnut varieties on farmers filed under farmers participatory mode approach. On field 25 FLD's were planned by AICRP on Groundnut, MARS, UAS, Dharwad, Karnataka on farmers' participatory mode approach under National Mission on Oilseeds and Oil Palm(NMOOP) programme and were conducted during *kharif*2021 with 25 farmers from Dharwad district. Each farmers field was considered as replication (25 no.) with 5 varieties as treatments and data was analysed statistically using Randomized complete block design. Statistical significance was tested with F test at 5 per cent level of probability. The study revealed that Dh-256(2850 kg $ha^{-1}$) and K-1812 (Kadri Lepaxi) (2745 kg $ha^{-1}$) recorded statistically on far dry pod yield. However, Dh-256 numerically out yielded K-1812 to the extent of 105 kg $ha^{-1}$. Haulm yield when compared to the other varieties. A significant reduction in stem rot incidence was observed with respect to Dh-256(3.5%), K-1812(3.8%), G2-52(4.5%) and GPBD-4(4.7%) when compared to JL-24(8.1%) which resulted significant reduction

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plant population of JL-24 at harvest though it was having higher harvest index. The additional cost of cultivation of Rs. 2000 was spent on JL-24 to manage foliar diseases. Significantly higher gross returns were of Rs.148405 $ha^{-1}$ and Rs.143460 $ha^{-1}$, respectively by cultivating Dh-256 and K-1812 as against Rs.115740 $ha^{-1}$ and Rs. 98728 $ha^{-1}$ of local improved popular variety GPBD-4 and farmers check variety JL-24, respectively. From the results, farmers were very satisfied with Dh-256 and K-1812 newly released varieties of UAS, Dharwad, Karnataka and ARS, Kadiri, Andhra Pradesh. During, *kharif*2021, groundnut crop growth season was normal (496 mm from South West Monsoon i.e., June to September) for the Dharwad district and it was 4% higher than normal rainfall of 479 mm for the same period in the region, Further, groundnut crop not suffered due to dry spell any point of its growing period.

*Keywords: Groundnut; pod yield; haulm yield; groundnut.*

## 1. INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is an importantoilseed crop grown in the arid andsemi-aridtropics of India under rainfed condition.Groundnut is cultivated in tropical, sub-tropical and warm temperate regions between $40^0$N and $40^0$S latitudes. The production is largely confined to Asian and African countries. Asia accounts for about 50% of area and 60% of world production of groundnut with largest share of India and China (>40%) in coverage, with highest share of China (40%) in the total production of groundnut in the World [1]. The five important states in India with respect to groundnut cultivation in terms of area, production and productivity are Gujarat,Tamilnadu, Karnataka, Maharashtra and Andhra Pradesh. In Karnataka, Groundnut is mainly growing in 10 districts namely Dharwad, Gadag, Haveri, Belgaum, Koppal, Raichur, Vijaypur, Bagalkot, Chitradurga and Tumkur. The cultivated area under groundnut in Karnataka is 3.8 lakh hectares as against 4.0 million hectares in India. The productivity is around 800 kg $ha^{-1}$ as against national productivity of 1500 kg $ha^{-1}$ [2]. The reasons for low productivity are many among them lack of improved variety, low seed replacement rate (SRR), untimely sowing, more area under rainfed cultivation, lack of protective irrigation either at sowing time or critical stage of pegging to pod development stage, lack of complete mechanisation in groundnut cultivation, higher seed and harvesting cost, incidence of biological threats namely defoliators and foliar diseases. These reasons are also indirectly responsible for reduction in groundnut area over the last one decade from 10.0 lakh hectares to 4.0 lakh hectares in Karnataka. This clearly indicates that need of demonstration of groundnut production technology on farmers field with improved package of practices along with improved varieties released from Agriculture Universities.

Further, regarding groundnut utility is concerned, the groundnut seed is used mainly for edible oil and contains nearly half of the essential vitamins (K & E) and one-third of the essential minerals. Hence, groundnut played an important role in nutritional security to the resource poor farmers. In addition, the haulms provided excellent fodder for livestock, cake obtained after oil extraction was used in animal feed and over all the crop acted as good source of biological nitrogen fixation [3].

Hence, the demonstrations are planned with the objectives to study-cum- evaluate the improved groundnut varieties with high yield under *kharif2021* season through FLD's on farmers field in Dharwad district of the Karnataka rather on research station.

## 2. MATERIALS AND METHODS

On farmers field 25 FLD's were planned by AICRP on Groundnut, MARS, UAS, Dharwad, Karnataka on farmers' participatory mode approach under National Mission on Oilseeds and Oil Palm (NMOOP) programme and were conducted during *kharif* 2021 with 25 farmers from Dharwad district. Each farmers field was considered as replication (25 no.) with 5 varieties as treatments and data was analysed statistically using Randomized Complete Block Design. Statistical significance was tested with F test at 5 per cent level of probability as suggested by Gomez and Gomez [4]. Sowing was performed under rainfed condition, depending on the onset of monsoon, sowing was completed between 10 and 15 June 2021. During the selection of the farmers for the study it was being confirmed that farmers have applied micronutrients @ 25 kg each of $ZnSO_4$ and $FeSO_4$under Karnataka state

Department of Agriculture Department Program i.e., *Bhoochetana* Program in collaboration with ICRISAT, Hyderabad. The plot size was 20×20 sq. m. i.e., 5 varieties in 1 acre area (4000 sq. m)with plant spacing of 30x10 cm. Three improved groundnut varieties *viz.* Dh-256, K-1812 (*Kadri Lepaxi*), G2.-52, GPBD-4 (Popular Variety of the region) and JL-24 (Farmers Check Variety) were taken for demonstration cum study purpose (Refer Table 1 for varietal characteristics). The recommended package of practices for groundnut cultivation followed as per UAS, Dharwad, Karnataka i.e., seed treatment with seed contact fungicide captan @ 3 g $kg^{-1}$ of seed along with basal application of recommended fertilizer dose of 18:46:25 kg N : $P_2O_5$ : $K_2O$ kg $ha^{-1}$. Since, the study was under farmers' participatory mode approach, farmers were being suggested to apply FYM @ 7.5 t $ha^{-1}$ at the time of land preparation and gypsum @ 500 kg $ha^{-1}$ at the time of pegging. One hand weeding at 20 days after sowing (DAS) and three inter-cultivations were carried out at 25, 35 and 45 DAS. Third cultivation was nothing nut earthing up following gypsum application. Since, the variety JL-24 was susceptible to foliar diseases and stem rot which required one additional plant protection of worth Rs. 2000 through spray of tebuconazole 250 EC (25.9% W/W) @ 1.5 l $ha^{-1}$. The different varieties were harvested as and when they were attained maturity as per variety specifications. The data on germination per cent, plant population at the time of germination and harvest, stem rot incidence, number of pods per plant, pod yield, haulm yield and cost of cultivation of all the varieties with prevailing market prices of inputs and farm operations were recorded. The harvest index, gross return, net return and harvest index of all the varieties were calculated.

## 3. RESULTS

The results obtained during the study cum demonstration along with statistical analysis were presented in Table 2.

Dh-256 and K-1812 groundnut varieties were recorded significantly higher dry pod yield of 2850 kg $ha^{-1}$ and 2745 kg $ha^{-1}$, respectively when compared to the local farmer's check variety JL-24(1908 kg $ha^{-1}$). The next best variety was G2-52 with dry pod yield of 2350 kg $ha^{-1}$and was in far with Dh-256 and K-1812 followed by GPBD-4 (2220 kg $ha^{-1}$). The excremental reasons for higher yield with Dh-256 and K-1812 were being significantly higher germination percentage (95.2% and 94.1%, respectively), actual plant population at harvest (305666 and 301000, respectively), lower stem rot incidence (3.5% and 3.8%, respectively) and higher number of pods per plant (19.7% and 19.3, respectively).

With regard to haulm yield, Dh-256 (3055 kg $ha^{-1}$), K-1812 (3465 kg $ha^{-1}$), G2-52 (2480 kg $ha^{-1}$) and GPBD-4 (2520 kg $ha^{-1}$) recorded statistically on far yield in order list. JL-24 recorded significantly lower haulm yield of 1908 kg $ha^{-1}$. While, the relation between total dry matter production and economic yield i.e., Harvest index is higher in JL-24 (0.57). Plant population may indirectly affect the amount of dry matter production due to its relationship with number of plants per unit area. In the present study higher harvest index with low economic yielding variety JL-24 was mainly because of lower haulm yield than economic yield. Whereas in other varieties haulm yield is higher than economic yield (Refer Table 2 row no. 7 and 8).

Significantly higher gross returns were of Rs.148405 $ha^{-1}$ and Rs.143460 $ha^{-1}$, respectively by cultivating Dh-256 and K-1812 as against Rs.115740 $ha^{-1}$ and Rs. 98728 $ha^{-1}$ of local improved popular variety GPBD-4 and farmers check variety JL-24, respectively. Similar trend was noticed with net returns (Dh-256 :Rs. 92855 kg $ha^{-1}$ and K-1812 : Rs. 87910 kg $ha^{-1}$). The highest B:C ratio was also recorded with Dh-256(2.67) and was on far with K-1812(2.58). The probable reason was lesser incidence of stem rot disease coupled with higher number ofpods $plant^{-1}$resulting higher pod and haulm yield,these results were in agreement with the findings of Vindhiyavarman et al*.* [5]. The local check variety JL-24 and popular variety among the farming community GPBD-4 were recorded 1.72 and 2.08, respectively.

A detailed score card was provided to theses farmers, as a effect, Dh-256 and K-1812 recorded as most preferred varieties as compared to G2-52, GPBD-4 and JL-24.

## 4. DISCUSSION

The results obtained during the study cum demonstration along with statistical analysis were presented in Table 2 and discussed as under.

**Table 1. Characteristics of varieties selected for front line demonstrations**

| Sl. No. | Variety | Characters / traits of the variety |
|---|---|---|
| 1 | Dh-256 | UAS, Dharwad's high yielding rainfed variety suitable for all seasons i.e., *Kharif*, *Rabi* and summer, drought resistant during mid of the growth season(40 to 60 days after sowing), 100 seed weight (42-45 g), foliar disease tolerant and matures in 115 to 120 days. Released in 2020. |
| 2 | K-1812 (Kadri Lepaxi) | ARS, Kadiri's (Andhra Prdesh) high rainfed variety suitable for kharif and summer season, 100 seed weight (44 to 48 g) and matures in 115 to 125 days. Released in 2020. |
| 3 | G2-52 | UAS, Dharwad's high yielding rainfed variety with uniform pod maturity, kernels resembles TMV-2 variety, suitable for *kharif* season only, 100 seed weight (40-45 g), foliar disease tolerant and matures in 115 to 120 days. Released in 2015. |
| 4 | GPBD-4 | UAS, Dharwad's high yielding rainfed variety with foliar disease resistant suitable for *kharif* season and seed production can be taken up during summer season, 100 seed weight (38-42 g) and matures in 115 to 120 days. Released in 2004. |
| 5 | JL-24 | ARS, Jalgaon's(Maharashtra) released medium yielding variety during 1990 and still farmer using it as local variety as it matures in 100 to 105 days but susceptible to foliar diseases. |

**Table 2. Performance of groundnut varieties in farmer's field (Average of 25 trials)**

| Sl. No. | Parameter | Dh-256 | K-1812 | G2-52 | GPBD-4 | JL-24 | CD (0.05) | CV(%) |
|---|---|---|---|---|---|---|---|---|
| 1 | Germination (%) | 95.2 | 94.1 | 93.4 | 93.2 | 89.50 | 2.85 | 5.65 |
| 2 | Plant population(Plants $m^{-2}$) | 30.6 | 29.3 | 28.5 | 27.9 | 24.2 | 3.20 | 10.52 |
| 3 | Recommended Plant Population($ha^{-1}$) | 333333 | 333333 | 333333 | 333333 | 333333 | - | - |
| 4 | Actual Plant Population at harvest($ha^{-1}$) | 305666 | 301000 | 296333 | 295000 | 271333 | 17167 | 18.20 |
| 5 | Stem rot incidence (%) | 3.5 | 3.8 | 4.5 | 4.7 | 8.1 | 2.30 | 6.65 |
| 6 | Number of pods $plant^{-1}$ | 19.7 | 19.3 | 16.9 | 16.1 | 15.1 | 2.10 | 5.89 |
| 7 | Dry pod yield(kg $ha^{-1}$) | 2850 | 2745 | 2350 | 2220 | 1908 | 582 | 12.36 |
| 8 | Haulm yield(kg $ha^{-1}$) | 3055 | 3465 | 2480 | 2520 | 1420 | 706 | 18.25 |
| 9 | Harvest index | 0.48 | 0.44 | 0.49 | 0.47 | 0.57 | 0.05 | 3.32 |
| 10 | Cost of cultivation(Rs $ha^{-1}$) | 55550 | 55550 | 55550 | 55550 | 57550 | - | - |
| 11 | Gross returns(Rs $ha^{-1}$) | 148405 | 143460 | 122330 | 115740 | 98728 | 23737 | 19.32 |
| 12 | Net returns(Rs $ha^{-1}$) | 92855 | 87910 | 66780 | 60190 | 41178 | 23737 | 19.99 |
| 13 | Benefit : cost ratio | 2.67 | 2.58 | 2.20 | 2.08 | 1.72 | 0.38 | 6.09 |

*Note: Price of groundnut dry pod yield=Rs.51.00 $kg^{-1}$, Price of groundnut haulm yield=Rs.1.00 $kg^{-1}$*

Dh-256 and K-1812 groundnut varieties were recorded significantly higher dry pod yield of 2850 kg $ha^{-1}$ and 2745 kg $ha^{-1}$, respectively when compared to the local farmer's check variety JL-24(1908 kg $ha^{-1}$). The next best variety was G2-52 with dry pod yield of 2350 kg $ha^{-1}$and was in far with Dh-256 and K-1812 followed by GPBD-4 (2220 kg $ha^{-1}$). The excremental reasons for higher yield with Dh-256 and K-1812 were being significantly higher germination percentage (95.2% and 94.1%, respectively), actual plant population at harvest (305666 and 301000, respectively), lower stem rot incidence(3.5% and 3.8%, respectively) and higher number of pods per plant (19.7% and 19.3, respectively).Similar results are reported by Tran Thi (2003) and Anil et al. (2008) who report increase grain yield with phosphorous application. Similar increase yield attributes and yield in different groundnut varieties with positive relation between yield attributes and negative relation between biotic stresses such as stem rot was observed by many workers namely Chuni Lal et al*.* [6], Mothilal et al. [5], Abdul-Rahman Tarawali and Daniel David Quee [7] at Sierra Leone Agricultural Research Institute (SLARI), Sierra Leone and Murugan and Nisha [8] under rainfed condition.

Further, susceptibility of JL-24 to stem rot and other foliar diseases was being reported by ChuniLal et al*.* [6] and Murugan and Nisha [8]. In the present study also similar results i.e., JL-24 recorded significantly higher stem rot incidence (8.1%) and lower yield attributes and lower dry pod yield (1908 kg $ha^{-1}$) and lower biomass(1420 kg $ha^{-1}$).

With regard to haulm yield, Dh-256 (3055 kg $ha^{-1}$), K-1812(3465 kg $ha^{-1}$), G2-52(2480 kg $ha^{-1}$) and GPBD-4 (2520 kg $ha^{-1}$) recorded statistically on far yield in order list. JL-24 recorded significantly lower haulm yield of 1908 kg $ha^{-1}$. While, the relation between total dry matter production and economic yield i.e., Harvest index is higher in JL-24(0.57). Plant population may indirectly affect the amount of dry matter production due to its relationship with number of plants per unit area. In the present study higher harvest index with low economic yielding variety JL-24 was mainly because of lower haulm yield than economic yield. Whereas in other varieties haulm yield is higher than economic yield (Refer Table 2 row no. 7 and 8). It may attributed to the reason that plant population mayindirectly affect the amount of dry matter production due to its relationship with number of plants per unit area as reported by Mukhtar et al*.* [9].

Significantly higher gross returns were of Rs.148405 $ha^{-1}$ and Rs.143460 $ha^{-1}$, respectively by cultivating Dh-256 and K-1812 as against Rs.115740 $ha^{-1}$ and Rs. 98728 $ha^{-1}$ of local improved popular variety GPBD-4 and farmers check variety JL-24, respectively.Similar trend was noticed with net returns (Dh-256 :Rs. 92855 kg $ha^{-1}$ and K-1812 : Rs. 87910 kg $ha^{-1}$). The highest B:C ratio was also recorded with Dh-256(2.67) and was on far with K-1812(2.58). The probable reason was lesser incidence of stem rot disease coupled with higher number ofpods $plant^{-1}$resulting higher pod and haulm yield,these results were in agreement with the findings of Vindhiyavarman et al*.* [10]. The local check variety JL-24 and popular variety among the farming community GPBD-4 were recorded 1.72 and 2.08, respectively.

A detailed score cardwas provided to theses farmers, as a effect, Dh-256 and K-1812 recorded as most preferred varieties as compared to G2-52, GPBD-4 and JL-24.

## 5. CONCLUSION

Groundnut variety, Dh-256 and K-1812 recorded more numberof pods per plant, less incidence of stem rot disease,higher pod yield and performed very well compared to G2-52, popular groundnut variety GPBD-4 and farmers check variety JL-24 underrainfed condition. Farmers were very satisfied with Dh-256 and K-1812groundnut varieties would be better option for rainfed cultivation during *kharif*season in northern transitional zone of Karnataka state.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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