Article AR2161 DOI: HTTPS://DOI.ORG/10.23910/1.2021.2161

International Journal of Bio-resource and Stress Management

February 2021

Crossref

Print ISSN 0976-3988

Online ISSN 0976-4038

IJBSM 2021, 12(1):064-067

Research Article *Stress Management*

Studies on Drought Tolerant and High Yielding Groundnut Varieties in Perambalur District

M. Punithavathi*, R. Vasanthakumar and V. Nethaji Mariappan

ICAR-Krishi Vigyan Kendra, Valikandapuram, Perambalur (621 115), India

Open Access

Corresponding Author

M. Punithavathi

e-mail: puniagri@gmail.com

Citation: Punithavathi et al., 2021. Studies on Drought Tolerant and High Yielding Groundnut Varieties in Perambalur District. International Journal of Bio-resource and Stress Management 2021, 12(1), 064-067. HTTPS://DOI.ORG/10.23910/1.2021.2161.

Data Availability Statement: Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

Conflict of interests: The authors have declared that no conflict of interest exists.

Abstract

Three varieties of groundnut were used to assess the drought tolerance and high yielding potential. Groundnut (*Arachis hypogaea* L.) is an important oil seed crop mainly grown under rainfed situation. Erratic rainfall and frequent drought during the crop growth period, groundnut yields are generally low under rainfed conditions. Drought during critical crop growth stages is crucial for loss in yield of groundnut varieties. But tolerant genotypes may give better yield due to maintenance of physiological responses that were triggered during drought. On Farm Trials was conducted by Krishi Vigyan Kendra, Hansroever campus, Perambalur district in Tamilnadu, India to assess suitable drought tolerant and high yielding groundnut variety in terms of yield, acceptability and adoption potential during *rabi* 2018-19 in Perambalur district, India. Three varieties of groundnut were used to assess the drought tolerance and high yielding potential *viz.,* Dharani, Co7 and TMV 7. The study revealed that Dharani recorded higher pod yield (2402 kg ha^{-1}), higher number of pods $plant^{-1}$ (26) and optimum plant population (26.3 plants m^{-2}) as compared to farmers practice. The groundnut variety Dharani resulted in the highest shelling percentage (75%), while the lowest was registered with TMV 7. Gross and net returns were ₹ 115324 and ₹ 66593 ha^{-1}, respectively by cultivating Dharani as against ₹ 87523 and ₹ 41550 ha^{-1} in the check variety. Dharani and Co_7 would be a better option forrainfed cultivation in Perambalur district.

Keywords: Groundnut, pod yield, rain fed, drought

1. Introduction

Groundnut, the king of oil seeds is one of the important legume crops cultivated predominantly under rain-fed conditions in the tropical and semi-arid tropical countries including India, where it provides a major source of oil, carbohydrates and proteins (Pasupuleti et al*.,* 2016; Ondulla, 2020). The seed is used mainly for edible oil and contains nearly half of the essential vitamins and one-third of the essential minerals. It is one of the most nourishing foods available in the world (Fonte et al., 2019; Samtiya et al., 2020). Apart from their nutritional value, groundnut has considerable medicinal value (Bhat et al., 2019). It is consumed in many ways and various forms. Due to its high monosaturated content, it is considered healthier than saturated oils and is resistant to rancidity (Juliet et al., 2019). Groundnut is particularly valued for its protein content (26%). In addition to protein and oil, groundnut is a good source of Ca, P, Fe, Zn and B. Hence, groundnut played an important role in nutritional security to the resource poor farmers (Meena et al., 2007; Chris et al.,

Article History

RECEIVED in 24th October 2020 RECEIVED in revised form 25th January 2021 ACCEPTED in final form 22nd February 2021

2020). In addition, the haulms provided excellent fodder for livestock, cake obtained after oil extraction was used in animal feed and overall, the crop acted as good source of biological nitrogen fixation (Nautiyal et al., 2011; Kumari and Reddy, 2019). Groundnut is the sixth most important oilseed crop in the world.

Globally, the crop is raised in 25.7 million ha with a total production of 37.1 million mt. The average productivity is 1400 kg ha^{-1}. India shares 22% of the world production (area 4.8 mha, production 5.9 million MT (Madhusudhana, 2013). The area under rainfed groundnut in Tamil Nadu is 4.4 lakh ha with a production of 9.11 lakh tones during *rabi* 2018-19. Groundnut is cultivated predominantly in the tropics and subtropics, where the availability of water is a major constraint on yield (Viramani and Singh, 1986; Happy et al., 2018). The crop is subjected to water deficit stress at one stage or another leading to drastic reduction in productivity. This necessitates development of cultivars which can withstand water stress and still can be productive. Reduction in peanut yield resulting from drought has been well documented (Nageswara Rao et al., 1989; Reddy et al., 2003) and Carvalho et al., 2017. Drought during the pod and seed forming stages has been shown to reduce pod yield of peanut by 56-85% (Vincent and Pasala, 2016). Hence, the study was planned with the objectives to evaluate the drought resistant groundnut varieties with high yield and drought tolerance under *rabi* season through on farm trials forPerambalur district.

2. Materials and Methods

The present study was carried out in eight farmers' field in Kadambur village of longitude 11'25'25 N and latitude 78''43''24'' E during 2018-19 to evaluate three genotypes of Groundnut evaluation traits. The trial was conducted in randomized block design (RBD) with three replications and total area under each trial was 0.4 ha. The land was brought to a fine tilth by repeated ploughing and harrowing. The clods were broken and debris was removed. The soil was leveled and ridges were made for sowing. For raising crop, recommended package of practices were followed. The seeds were sown during November to September during, 2018, crop thinning was done for maintaining proper plant spacing of 30×10 cm^2. The soil of the experimental site was sandy clay loam texture with medium organic carbon content (0.55%), medium in nitrogen (285.0 kg ha^{-1}), low in phosphorus (10.6 kg ha^{-1}) and medium in potassium (172.0 kg ha^{-1}) contents. Before fertilizer application, random soil samples were taken from the experimental sites and recommended dose of fertilizers applied as per soil test basis. The farming situation was rainfed and source of supplemental irrigation with bore well. The treatments included: T_1: Farmers Practice, T_2: Dharani and T_3: Co_7. Five plants were selected randomly from each plot for recording observations. The data on plant population, physiological parameters, number of pods plant^{-1}, pod yield, haulm yield and economics of all the varieties were recorded. Observations on growth characters such as plant height, dry matter production were recorded at 40 DAS, 80 DAS and at harvest from five randomly selected plants in each plot. The samples were collected from sampling rows in each plot for dry matter production and were used for the estimation of DMP. The data obtained from experiments were subjected to statistical analysis by using the statistical software AGRES. Based on the net plot yield, yield ha^{-1} was calculated and expressed in q ha^{-1}. The cost of cultivation and gross returns were worked out by using prevailing market prices of inputs during the period of investigation. Benefit-cost ratio (BCR) was worked out by using the following formula. Benefit: Cost ratio (BCR) = Gross return (₹ ha^{-1})/ Total cost of cultivation (₹ ha^{-1}) (Table 1 and 2).

3. Results and Discussion

3.1. Growth parameters

With regard to evaluation of groundnut varieties significant difference were observed on plant height at 40 DAS, 80 DAS

Table 1: Details of practices in Perambalur district under OFT programme

Sr. No.	Cultural operation	Existing practice	Improved cultivation practice
1.	Variety	TMV 7	Dharani and Co_7
2.	Seed rate	50-60 kg ha^{-1}	50 kg ha^{-1}
3.	Seed quality	Ungraded seed	Graded seed
4.	Seed treatment	No seed treatment	Treated with Rhizobium and Phosphobacteria
5.	Method of sowing	Broadcasting	Line sowing
6.	Fertilizer application		54 kg Urea+312 kg SSP+124 kg Potash, Gypsum 120 kg ha^{-1}

Table 2: Characteristics of varieties selected for on-farm trial

Sl. No.	Variety	Source	Duration (days)	Shelling percentage	Oil content	Potetial yield (kg ha^{-1})
1.	T_1: Farmer practice variety (TMV 7)	TNAU, 1967	100-105	74	49.6	1900 kg ha^{-1}
2.	T_2: Dharani	RARS, 2013	100-105	75	49.8	25.00 kg ha^{-1}
3.	T_3: CO_7	TNAU, 2013	100-105	71	51.0	23.00 kg ha^{-1}

and at harvest stage. Dharani recorded the highest value for plant height of 12.2, 33.4 cm and 44.2 cm at 40 DAS, 80 DAS and at harvest stages, respectively (Table 3). It was least in farmer practice at 80 DAS and at harvest. Higher plant height in Dharani may be attributed to the variety which tends to germinate and establish early compared to farmer practice varieties with medium and small seeds. Similar increase in plant height with large seeds was also observed by Singh et al. (1998) and Nandania et al. (1992). Mensah and Okpere (2000) showed the significant differences among the different varieties of groundnut for plant height throughout the growth period.

The variety, Dharani maintained the highest dry matter production (3730 kg ha^{-1}) on the account of higher magnitude of dry matter in leaves, stem and roots (Table 3). In addition, Co7 and TMV 7also recorded dry matter production of 3308 $kgha^{-1}$ and 3105 kg ha^{-1} respectively. Among varieties (Dharani) recorded higher relative leaf water content (RLWC) of 67.5 at flowering stage (Table 4). The lowest relative leaf water content was recorded in farmer's practice. The highest reduction was recorded in farmer practice (48.4%). Sunitha et al. (2015) suggested that RWC under stress condition could be used as measure of tolerance to stress. Decline in RWC under drought stress was observed earlier growth stage in groundnut. This might be due to reduction in water availability, higher stomata opening and closing. Similar results have been reported in groundnut (Kalariya et al., 2017), in horsegram (Bhardwaj and Yadav, 2012) and in pigeonpea (Kumar et al., 2011). The results obtained in the present study are in agreement with these reports. The chlorophyll content also decreased significantly under stressed condition in all genotypes of groundnut. It has been reported that the loss of chlorophyll under water stress is due to inactivation of photosynthesis (Kumar et al., 2011), furthermore, stress induced reduction is ascribed to loss of chloroplast membrane integrity due to lipid peroxidation.

Table 3: Growth performance on groundnut varieties in farmer's field (Average of five trials)

Variety	Plant height (cm)	DMP (Kg)	Plant height (cm)	DMP (Kg)	Plant height (cm)	DMP (Kg)
T_1: Farmer practice variety (TMV 7)	10.8	1813	27.5	2984	30.0	3105
T_2: Dharani	11.3	1320	31.6	3380	37.3	3308
T_3: CO_7	12.2	1868	33.4	3588	44.2	3730
SEd±	0.52	87.6	1.58	170	1.78	177
CD (*p*=0.05)	1.04	NS	3.32	372	3.64	368

Table 4: Chlorophyll and RWC in groundnut leaves during water stress

Variety	Chlorophyll (mg g^{-1} fr.wt)	Relative water content (%)
T_1: Farmer practice variety (TMV 7)	1.3	48.4
T_2: Dharani	1.68	51.6
T_3: CO_7	1.93	67.5
SEd±	0.06	2.53
CD (*p*=0.05)	0.12	5.06

3.2. Yield attributes and yield

On-farm trials on varietal evaluation of groundnut varieties revealed that groundnut variety Dharani recorded higher pod yield (24 kg ha^{-1}), higher number of pods $plant^{-1}$ (26), lesser root rot incidence (1.4%) and optimum plant population (26.3 plants m^{-2}) as compared to Co_7 and farmer practice variety in (Table 4). Groundnut varieties, Dharani and CO_7 recorded 31.76 and 13.82% higher pod yield than check variety, respectively. With regard to haulm yield, Dharani variety recorded highest haulm yield of 4384 kg ha^{-1} compared to other varieties. Similar results have been reported in groundnut (Kumari and Reddy, 2018).

4. Economics

Gross and net returns were ₹ 1,15,324/- and ₹ 66,593 ha^{-1}, respectively for CO_7 as against ₹ 99,619/- and ₹ 52,277 ha^{-1} in the farmers variety. The probable reasonmight due to genotype, lesser incidence of root rot disease coupled with higher number of pods $plant^{-1}$ resulting higher pod and haulm yield, these results were in agreement with the findings of (Kumari and Reddy, 2019).

5. Conclusion

Groundnut variety, Dharani recorded more number of pods per plant, higher pod yield, good withstand under drought condition and performed very well compared to Co_7 and TMV7farmer practice variety under rainfed condition. Farmers are convinced with dharani, as the crop did not suffer from a dry spell of 18-22 days without rain. Thus, groundnut variety Dharani would be better option for rainfed cultivation during *rabi* season for Peramalur district.

6. References

Bhardwaj, J., Yadav, S.K., 2012. Comparative study on biochemical parameters and antioxidant enzymes in a drought tolerant and a sensitive variety of horse gram under drought stress. American Journal of Plant Physiology 7(1), 17–29.

Bhat, E.A., Sajjad, N., Manzoor, I., Rasool, A., 2019. Bioactive Compounds in Peanuts and Banana. Journal of Biochemistry and Analytical Biochemistry 8(2), 382.

Carvalho, M.J., Vorasoot, N., Puppala, N., Muitia, A., Jogloy, S.,

2017. Effects of terminal drought on growth, yield and yield components in Valencia peanut genotypes. Journal of Breeding and Genetics 49(3), 270−279.

Chris, O., Pasupuleti, J., Bhatnagar, P.M., Pandey, M., 2020. Advances in crop improvement and delivery research for nutritional quality and health benefits of groundnut. Frontiers in Plant Science 22(1), 21−27.

Fonte, H., Marta, F., Citelli Georgia, C., Atella Helena, F.R., Zago, L., Thamiris de, S., Simone Vargas da, S., Christina, B.F., 2019. Oil supplementation changes body composition and activates insulin signaling cascade in skeletal muscle tissue of obese animals. Nutrition 58(1), 167–174.

Juliet, H., Musalima Patrick, O., Diriisa, M., 2019. Fatty acid composition of oil from groundnuts and oyster nuts grown in uganda. Journal of Food Research 8(6) 201−206.

Kalariya, K.A., Deepti, M., Nisha, G., Singh, A.L., 2017. Stomatal clustering pattern in *Arachis hypogaea* L. under water deficit stress. Indian Journal of Experimental Biology 55(1), 880−883.

Kumar, R.R., Karajol, K., Naik, G.R., 2011. Effect of polyethylene glycol induced water stress on physiological and biochemical response in pigeonpea. Plant Physiology 3, 1487−152.

Happy, D., Hussein, S., Mark, L., Patrick, O., Omari, M., 2018. Groundnut production constraints, farming systems, and farmer-preferred traits in Tanzania. Journal of Crop Improvement 32(6), 812−828.

Madhusudhana, B., 2013. A survey on area, production and productivity of groundnut crop in india. Journal of Economics and Finance 1(3), 1−7.

Meena, S., Malarkodi, M., Senthilvalavan, P., 2007. Secondary and micronutrients for groundnut. 2007. Agricultural Reviews 28(4), 295−300.

Mensah, J.K., Okpere, V.E., 2000. Screening of four groundnut cultivars from nigeria for drought resistant. Legume Research 23(1), 37−41.

Nageswara Rao, R.C., Williams, J.H., Singh, M., 1989. Genotypic sensitivity to drought and yield potential of peanut. Agronomy Journal 81, 887−883.

Nandania, V.A., Modhawadia, M.M., Patel, J.C., Sadaria, S.G., Patel, B.S., 1992. Response of rainy season bunch groundnut to row spacing and seed rate. Indian Journal of Agronomy 37(3), 597−599.

Nautiyal, P.C., Zala, P.V., Tomar, R.K., Sodayadiya, P., Tavethia, B., 2011. Evaluation of water use efficiency newly developed varieties of groundnut in on-farm trials in two different rainfall areas in Gujarat, India. SAT eJournal / eJournal.icrisat.org 9, 1−6.

Ondulla, T.T., 2020. A comprehensive review of the value-added uses of peanut skins and by-products. Critical Reviews in Food Science and Nutrition 60(2), 341−350.

Pasupuleti, J., Pandey, K.M., Yaduru, S., Murali, T.V., Manda, S., Khera, P., Surendra, S.M., Nagesh, P., Vishwakarma, K.M., Mishra, G.P., Radhakrishnan, T., Manivannan, N., Dobariya, K.L., Vasanthi, R.P., Rajeev, K.V., 2016. Molecular breeding for introgression of fatty acid denatures mutant alleles (ahFAD2A and ahFAD2B) enhances oil quality in high and low oil containing peanut genotypes. Plant Science 242, 203−213.

Kumari, C., Reddy, B.S., 2019. Evaluation of groundnut varieties for drought tolerance under imposed moisture stress conditions. Journal of Oilseeds Research 36(1), 24−29.

Samtiya, M., Aluko, R.E., Dhewa, T., 2020. Plant food anti-nutritional factors and their reduction strategies. Food Production Processing and Nutrition 6(2), 202−206.

Singh, P., Thakur, D., Vaish, C.P., Katiyar, R.P., Gupta, P.K., 1998. Studies on packing materials for storage of soybean seeds under ambient conditions. Journal of Indian Society of Seed Technology 28(4),75.

Sunitha, V.M., Vanaja, P., Sowmya, S.K., Abdul Razak, G., Vijay Kumar, Y., Anitha, N., Lakshmi, J., 2015. Variability in response of groundnut (*Arachis hypogaea* L.) genotypes to moisture stress and stress release. International Journal of Bio-resource and Stress Management 6(2), 240−249. DOI: 10.5958/0976-4038.2015.00042.1.

Virmani, S.M., Singh, P., 1986. Agroclimatological Characteristics of the groundnut-growing regions in the semi-arid tropics. International Symposium-Agrometeorology of Groundnut, 21−26.

Vincent, V., Pasal, R., 2016. High transpiration efficiency increases pod yield under intermittent drought in dry and hot atmospheric conditions but less so under wetter and cooler conditions in groundnut (*Arachis hypogaea* (L.)). Field Crops Research 193, 16–23.