DoI: https://doi.org/10.58537/jorangrau.2023.51.3.03

J. Res. ANGRAU 51 (3) 20-27, 2023

IMPACT OF SPRAYING 19:19:19 AS A DROUGHT MITIGATION TECHNIQUE ON YIELD AND B:C RATIO OF RAINFED GROUNDNUT IN CHITTOOR DISTRICT

SAHAJA DEVA*, R. PRASANNA LAKSHMI and M.K. JYOSTHNA

Krishi Vigyan Kendra, Achayra N.G. Ranga Agricultural University, Kalikiri - 517 234

Date of Receipt : 01.5.2023 Date of Acceptance : 31.7.2023

ABSTRACT

The on-farm trial was conducted in the farmer's fields of Chittoor district to assess the impact of spraying of 19:19:19 during water stress conditions of groundnut crop on yield and profitability during *kharif,* 2021 and *kharif,* 2022. Treatments assessed comprised of spraying of 0.5% 19:19:19 twice during the water stress conditions, spraying of 2% urea twice during water stress conditions and farmers practice (without spraying). Results of the study revealed that spraying of 0.5% 19:19:19 and 2% urea recorded 9.9% and 7.4% enhancement in the pod yield than the farmers practice (9.42 q ha^{-1}). It was also recorded that spraying of 19:19:19 improved the number of filled pods per plant, 100 pod weight and seed weight by 25.1 g, 93.6 g and 38.9 g and by spraying of 2% urea by 24.9 g, 91.5 g and 37.0 g. Economic analysis revealed that additional cost of spraying of 19:19:19 (Rs.300/-) and urea (Rs.625/-) resulted in additional income of Rs.5005 ha^{-1} and Rs.3596 ha^{-1}, respectively with a B:C ratio of 1.09 and 1.08, whereas, in farmers practice B:C ratio was found to be 1.00.

Keywords:19:19:19, Drought, Rainfed Groundnut, Urea and Yield

INTRODUCTION

Groundnut is the 13th most important food crop, 4th important source of vegetable oil and 3rd main source of vegetable protein in the world. (Shete *et al*., 2018). Groundnut is the major oilseed crops of India which accounts for 25% of total oilseed production in the country. Among the oilseed cultivated in India, groundnut occupies 22.98 percent area (5.30 million ha) and 14.52 percent (5.50 million tonnes) of total production and productivity of 1040 kg ha^{-1} (http://www.indiastat.com). In Andhra Pradesh, groundnut is cultivated in an area of 7.48 lakh ha with production of 4.62 lakh tonnes production and productivity of 618 kg ha^{-1} (http://www.indiastat.com). In Chittoor district, groundnut is one of the major oilseeds crop and ranks first in area and production in Andhra Pradesh. The crop was cultivated in 1.23 lakh ha during *kharif*, 2020-21 and 2,124 ha during *rabi*, 2020-21 in Chittoor. (O/o JDA, Chittoor). Groundnut is a self-fertilizing crop, neverthless, it is exhaustive crop when compared to other legumes because a very little portion of the plant residue is left in the soil after harvest. (Shete *et al*., 2018). It is cultivated in diverse agro-climatic environments characterized by soils of varying water holding capacity under rainfed as well as irrigated conditions (Priya *et al.*, 2016). It is planted in arid and semi-arid areas and is rich in protein and oil of good quality. Drought is one of the limiting factors to groundnut yield in

*Corresponding Author E-mail i.d: sahajadeva@angrau.ac.in

many countries and is resistant to water stress conditions but drought conditions adversely effect the pod yield and seed quality (Rajitha *et al*., 2018). In western mandals of Chittoor, farmers are growing varieties which are not tolerant to drought conditionsas a result, yields are reducing drastically and causes economic loss to farmers during moisture stress conditions. To mitigate the problem and to get good returns to farmers there is need to introduce technologies which can protect crop from water stress conditions and improve the yielding capacity of the crop. Hence, spraying of foliar fertilizers like 19:19:19 during water stress conditions was tested in the farmers fields.

MATERIALS AND METHODS

An on-farm trial was conducted by Krishi Vigyan Kendra, Kalikiri during two consecutive *kharif* seasons of 2021 and 2022 to assess the performance of drought mitigation technologies such as spraying 0.5% 19:19:19 and 2% urea twice during dry spell in rainfed groundnut. Sites for the on-farm testing were selected when wilting symptoms were observed in the field. Groundnut variety Kadiri 6 (Table 1) was taken as test variety as this variety cannot tolerate moisture stress conditions.Trials were conducted in 2.0 ha area in five farmers fields during *kharif,* 2021 and 2022 in Chintalavaripalli village, Kalikiri mandal with two technologies and farmers practice. In Technology Option 1, spraying was done with 0.5% 19:19:19 twice during vegetative and pod development stage. In Technology Option 2 spraying was done with 2% urea and in Farmers practice no spraying was done. Soils of the study area are sandy loam in texture with low available nitrogen and phosphorus, high in potassium, deficit in zinc and iron. The OFTs were laid out in rainfed fields with groundnut as mono crop is more prevalent in the area. Seeds were sown at a depth of 5 cmwith seed drill during *kharif* in the month of Juneat 30 cm spacing. Pre emergence spraying of Pendimethalin @ 1.0 lac^{-1} was done within 24 hours after sowing. One farmer field was split into three plotsand treatments were imposed. Each treatment was replicated in five farmers' fields during both the years. During *kharif*, 2021, prolonged dry spells were observed in the months of August and September. Whereas during 2022, during July, August and September prolonged dry spells were observed. In treatment plots, first spraying of 19:19:19 and urea was done during August when crop was in flower initiation stage as wilting was observed due to moisture stress conditionsdue to prolonged dry spells for 20 days. Second spraying was done during September at pod development stage as again there was moistures stress condition. Rainfall data is given in Table 2. Farmers have applied 20 q FYM $acre^{-1}$, urea @ 25 kg ac^{-1}, SSP @ 100 kg ac^{-1} and MOP @ 35 kg ac^{-1}. The data recorded on various parameters such as dry pod, seed weight and yield were analysed.The average prices of input and output prevailed during each year were taken for calculating cost of cultivation, gross returns, net returns and benefit-cost ratio.

RESULTS AND DISCUSSION

Yield attributes: The treatment which received sprays with 19:19:19, urea recorded 25.1 and 24.9 average no. of pods $plant^{-1}$ in the field as compared to farmers practice (24.1) (Table 3). Spraying of 19:19:19 recorded significantly higher mean 100 dry pod weight (93.6 g) followed by spraying with urea (91.5 g) over farmers practice (79.6 g). Similarly, significantly higher 100 dry seed weight was observed in the treatment where spraying was done with 19:19:19 (38.9 g)and wasfollowed by spraying with urea (37.0 g) alone and both the technologies were better than the farmers practice (24.8 g). Water stress condition reduced the mature number of pods slightly. These findings are similar to the findings of Bootang *et al*. (2014). Due to water stress pod and seed filling may be affected which in turn reduce pod and seed weight in farmers practice.

Yield: Data presented on yield revealed that spraying of 19:19:19 recorded substantially higher pod yield (105 kg ha^{-1}) over farmers practice during both the years. Perusal of the data (Table 3) revealed that in technology option 1 (10.50q ha^{-1} and 10.20 q ha^{-1} during 2021-22 and 2022-23, respectively), was found to be significantly superior

Table 1. Salient features of groundnut variety Kadiri- 6

S.No.	Variety	Duration (No. of day)	Pod yield (q ha^{-1})		Shelling %	100 seed weight (g)	Oil content (%)	Special features
			kharif	*rabi*				
1	Kadiri-6	100-105	8-8.8	16-17	72	40-45	48	Popular among farmers for its quality attributes

Table 2. Rainfall data during crop growth period

S.No.	Date	June 2021	July 2021	August 2021	September 2021	June 2022	July 2022	August 2022	September 2022
1	01	13.4	-	-	-	-	6.4	42.0	14.4
2	02	-	-	-	53.0	2.0	-	83.2	1.2
3	03	-	-	-	22.0	-	-	62.8	-
4	04	-	27.4	-	19.4	-	-	-	-
5	05	29.4	-	-	-	-	-	-	-
6	06	25.6	-	-	14.6	1.2	-	17.4	-
7	07	-	-	-	-	-	7.4	-	22.0
8	08	-	37.4	-	-	-	-	-	32.2
9	09	-	-	-	-	-	-	-	3.2
10	10	-	-	-	-	-	5.2	-	-
11	11	-	-	-	-	-	-	-	1.2
12	12	-	-	-	-	-	-	-	-
13	13	4.4	-	-	-	35.0	-	-	-
14	14	-	42.0	-	-	-	-	-	-
15	15	-	-	-	-	35.2	-	-	-
16	16	-	10.4	-	-	-	-	-	-
17	17	-	15.4	-	-	-	-	10.4	-
18	18	-	-	-	-	-	-	-	-
19	19	-	8.4	-	-	5.0	-	-	-
20	20	-	-	-	-	39.0	-	-	-
21	21	-	-	-	-	-	-	-	-
22	22	-	-	-	-	-	-	-	-
23	23	-	-	-	17.4	4.0	-	-	-
24	24	3.4	-	10.4	-	-	-	-	-
25	25	-	-	13.4	-	-	-	1.4	-
26	26	-	-	-	67.6	-	1.0	42.2	-

Table 1 Contd...

Table 1 Contd...

S.No.	Date	June 2021	July 2021	August 2021	September 2021	June 2022	July 2022	August 2022	September 2022
27	27	-	-	42.0	-	-	-	7.4	-
28	28	-	4.6	33.0	-	-	-	6.2	-
29	29	-	-	13.4	4.6	-	-	6.4	-
30	30	-	-	-	75.6	4.6	-	-	1.4
31	31	-	-	-	-	-	-	-	-
32	No. of rainy days	05	07	05	08	06	03	09	04
33	**Total (mm)**	**76.2**	**145.6**	**112.2**	**274.2**	**126.0**	**20.0**	**279.4**	**75.6**

than technology option 2 (10.21 q ha^{-1} and 10.01 q ha^{-1} during 2021-22 and 2022-23, respectively) and farmers practice (9.45 q ha^{-1} and 9.38 q ha^{-1} during 2021-22 and 2022-23) during both the years as well as in pooled data. During *kharif,* 2021, an additional yield of 105.0 kg ha^{-1} and 76.0 kg ha^{-1} was recorded due to spraying with 19:19:19 and urea, respectively when plant showed sign of wilting under moisture stress and during *kharif,* 2022, an additional yield of 82.0 kg ha^{-1} and 63.0 kg ha^{-1} was recorded. On an average additional yield of 93.5 kg ha^{-1} and 69.5 kg ha^{-1} were recorded in fields treated with foliar spraying of 19:19:19 and urea, respectively.Spraying of 19:19:19 recorded 9.9% higher yield compared to farmers practice.There was significant difference between treatments and farmers practice at 5% level (Table 4). Yield is an end product which obviously depends on dry matter production, number of pods per plant, 100 pod and seed weight. The improvement in the dry matter production may be due to the instant assimilation of nutrients supplied through foliar application meeting the required nutrient demand of the crop during the critical crop growth periods (Vinod and Salakinkop, 2017). Similar observations were made by Dalei *et al.* (2014) in niger crop. The increased yield might be due to the role of nitrogen fertilizer in increasing photosynthetic rate, synthesis of metabolites and translocation of assimilates to the seed (Rajitha *et al*., 2018). Naveen *et al*. (2015) stated that in groundnut, higher dry pod yield was obtained with foliar application of fertilizers during water stress conditions.Similar findings were also reported by Thakur *et al*. (2017) in pulses and Sharma (2016) in wheat farmers fields.

Economics: Based on average prices of inputs and output commodities prevailed during each year of assessment, values of economic indicators like cost of cultivation, gross returns, net returns and B:C ratio were calculated (Table 5). Gross returns, net returns and B:C ratio were higher when compared to farmers practice (Table 5). Average gross returns of technology option 1 (spraying with 19:19:19) and technology option 2 (spraying with 2% urea) were Rs.56,925 and Rs.55,605 ha^{-1}. Whereas, in farmers practice, gross returns were Rs.51,782 ha^{-1}. Economic analysis revealed that spraying of 19:19:19 provided higher net returns over farmers practice during both the years of study. Treatment 1 fetched average net returns of Rs.4922 ha^{-1} and spraying of 2% urea fetched net returns of Rs. 3750 ha^{-1}. In farmers practice, negative net returns of Rs.82.5 ha^{-1} were obtained which means there was a loss to the farmers. Additional cost of 19:19:19 and urea spraying worked out to be Rs.300 and Rs. 62.5 ha^{-1}, respectively during both the years which in turn provided additional returns of Rs.5475 and Rs.3644 ha^{-1}, respectively during 2021-22 and Rs.4535 and Rs.3548 ha^{-1}, respectively during

Table 3. Yield attributes and yield of drought mitigation technologies and farmers practice

S.No.	Particulars	Year		Mean
		2021-22	2022-23	
1	**Number of pods per plant**			
2	TO1	25.2	25.0	25.1
3	TO2	24.9	24.8	24.9
4	Farmers practice	24.0	24.2	24.1
5	**100 dry pod weight (g)**			
6	TO1	94.6	92.5	93.6
7	TO2	92.7	90.3	91.5
8	Farmers practice	80.4	78.7	79.6
9	**100 dry seed weight (g)**			
10	TO1	38.8	38.9	38.9
11	TO2	37.3	36.7	37.0
12	Farmers practice	25.7	23.9	24.8
13	**Yield (q ha^{-1})**			
14	TO1	10.50	10.20	10.35
15	TO2	10.21	10.01	10.11
16	Farmers practice	9.45	9.38	9.42
17	**Additional yield due to spraying (kg ha^{-1})**			
18	TO1	105.0	82.0	93.5
19	TO2	76.0	63.0	69.5
20	Farmers practice	-	-	-
21	**Increase in yield (%)**			
22	TO1	11.1	8.7	9.9
23	TO2	8.04	6.7	7.4
24	Farmers practice	-	-	-

TO1: Spraying of 0.5% 19:19:19 twice during dry spells TO2: Spraying of 2% urea twice during dry spells
Farmers practice: No spraying

Table 4. Summary of one way ANOVA in comparing yield in treatments and farmers practice

S.No.	Particulars	Treatments	N	Mean	Std. Deviation	F-value	p-value
1		TO1	5	10.35	0.40	5.69*	0.02
2	Yield	TO2	5	10.11	0.56		
3		Farmers practice	5	9.42	0.21		

***Significant at 5% level**

Table 5. Economics of drought mitigation technologies and farmers practice

S. No.	Particulars	Year		Mean
		2021-22	2022-23	
1	**Cost of cultivation (Rs. ha^{-1})**			
2	TO1	52800.00	51205.00	52002.5
3	TO2	52562.50	51147.00	51854.8
4	Farmers practice	52500.00	51230.00	51865.0
5	**Additional cost for spraying (Rs. ha^{-1})**			
6	TO1	300.00	300.00	300.0
7	TO2	62.50	62.50	62.5
8	Farmers practice	-	-	-
9	**Gross returns (Rs. ha^{-1})**			
10	TO1	57750.00	56100.00	56925.0
11	TO2	56155.00	55055.00	55605.0
12	Farmers practice	51975.00	51590.00	51782.5
13	**Net returns (Rs. ha^{-1})**			
14	TO1	4950.00	4895.00	4922.5
15	TO2	3592.50	3908.00	3750.3
16	Farmers practice	-525.00	360.00	-82.5
17	**Additional net returns due to spraying (Rs. ha^{-1})**			
18	TO1	5475.00	4535.00	5005.0
19	TO2	3644.50	3548.00	3596.3
20	Farmers practice	-	-	-

Table 5. Economics of drought mitigation technologies and farmers practice

S.No.	Particulars	Year		Mean
		2021-22	2022-23	
21	**B:C ratio**			
22	TO1	1.09	1.09	1.09
23	TO2	1.07	1.08	1.08
24	Farmers practice	0.99	1.01	1.00

TO1: Spraying of 0.5% 19:19:19 twice during dry spells TO2: Spraying of 2% urea twice during dry spells Farmers practice(control): No spraying

2022-23. Spraying of 19:19:19 and urea obtained mean B:C ratio of 1.09 and 1.08, respectively which was at par with each other and significantly higher than farmers practice (1.0). Overall, B:C ratio was also found higher in technologies over farmers practice which clearly indicates that spraying of 19:19:19 might be economically feasible and profitable techniques on farmer's fields. Sharma (2016) also reported 19:19:19 to be economical at farmers fields in Rajasthan. Farmers' were also found highly convinced with the technological interventions due to higher economic returns with least additional investment and management practices. The variation in cost benefit ratio during different years might be due to variation in yield performance and input output cost in that particular year. Similar findings were recorded by Sharma and Singh (2020). Spraying of 19:19:19 in groundnut when there are prolonged dry spells is economically beneficial to farmers.

CONCLUSIONS

One-way ANOVA was carried out to compare three treatments effects on yield of rainfed groundnut. It is noticed that there is significant difference among the three treatments at 5% level ($p<0.05$). Spraying of 19:19:19 showed higher yield (10.35 q ha^{-1}) followed by spraying of urea (10.11 q ha^{-1}). It is concluded that spraying of 0.5% 19:19:19 during moisture stress conditions found to be remunerative and economically viable option to farmers to protect crop during prolonged dry spells of 15-20 days with 19:19:19 twice within one week to 10 days interval.

REFERENCES

Bootang, S., Girdthai, T., Jogloy, S., Akkasaeng, C., Vorasoot, N., Patanothai, A and Tantisuwichwong, N. 2014. Responses of released cultivars of peanut to terminal drought for traits released to drought tolerance. Asian Journal of Plant Sciences. 9(7): 423-431.

Dalei, B. B., Kheroar, S., Mohapatra, P. M., Panda, S and Deshmukh, M. R. 2014. Effect of foliar sprays on seed yield and economics of niger (*Guizotia abyssinica* L.). Journal of Agricultural Sciences. 6(6): 143-147.

GoI. 2023. Area, Production and Productivity of Groundnut in India. Retrieved from website (http://indiastat.com) on 17.06.23.

GoI. 2023. Area, Production and Productivity of Groundnut in Andhra Pradesh. Retrieved from website (http://indiastat.com) on 17.06.23.

Naveen kumar, B.T., Malligawad, L.H., Halikatti, S.I., Hiremath, S.M., Srineevasa, M.N and Bidari, B.I. 2015. Effect of different ratios and levels of nitrogen and phosphorus fertilizers, and top dressing of nitrogen fertilizers on growth and yield of groundnut. Karnataka Journal of Agricultural Sciences. 28(1): 8-11.

Priya,T., Subramanyam, D and Sumathi, V. 2016. Performance of groundnnut (*Arachis hypogaea* L.) cultivars under different plant populations during early Kharif. Indian Journal of Agricultural Research. pp. 50-51.

Rajitha, B., Latha, P., Sudhakar, P and Umamahesh, V. 2018. A comparative study on the effect of foliar application of nitrogen, phosphorus, potassium, iron and zinc on proline content, yield and cost-benefit ratio of groundnut plants grown under water stress conditions. International Journal of Pure and Applied Biosciences. 6(1):784-789.

Sharma, N.K. 2016. Effect of foliar fertilization of NPK on wheat grain yield at farmer's field. Indian Journal of Extension Education. 24: 193-196.

Sharma, K.M. and Singh, M. 2020. Assessment of water soluble NPK foliar nutrition in wheat (*Triticum aestivum* L.) through on-farm testing for improving yield and economic returns. International Journal of Science, Environment and Technology. 9 (3): 510 – 515.

Shete, S.S., Bulbule, A.V., Patil, D.S. and Pawar, R.B. 2018. Effect of foliar nutrition on growth and uptake of macro and micronutrients of *Kharif* Groundnut (*Arachis hypogea* L.). International Journal of Current Microbiology and Applied Sciences. 7(10):1193-1200.

Thakur, V., Teggelli, R.G and Meena M.K. 2017. Influence of foliar nutrition on growth and yield of pulses grown under north eastern dry zone of Karnataka, A Review. International Journal of Pure and Applied Biosciences. 5(5):787-795.

Vinod Kumar, H.M and Salakinkop, S.R. 2017. Growth analysis in groundnut (*Arachis hypogea* L.) as influenced by foliar nutrition. Legume Research. 40(6):1072-1077.

Deva,S., Prasanna Lakshmi, R and Jyosthna, M.K.2023. Impact of spraying 19:19:19 as a drought mitigation technique on yield and B.C ratio of rainfed groundnut in chittoor district. The Journal of Research ANGRAU. 51 (3):20-27.
DoI: https://doi.org/10.58537/jorangrau.2023.51.3.03