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Effect of Irrigation Scheduling and Foliar Organic Nutrition on Yield and Economics of Summer Groundnut (*Arachis hypogaea L.*)

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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

A field experiment was conducted during *summer* season of 2022 at Crop Research Farm (CRF), Department of Agronomy, SHUATS, Prayagraj (UP) on soil with sandy loam in texture to investigate the effect of Irrigation Scheduling and Foliar Organic Nutrition on growth and yield of Zaid Groundnut. The treatments consist of three Irrigation Schedulings viz., I_1: 3 Irrigations (25,45,70 DAS), I_2: 2 Irrigations (25,45 DAS), I_3: 2 Irrigations (25,70 DAS) and three Foliar Organic Nutrition Comprising of F1 – Panchagavya at 3%, F2 – Jeevamrutha at 3%, F3 – Panchamrutha at 3% whose effect is observed on Groundnut (var. Kadiri-6). The experiment was laid out in Randomized Block Design with Ten treatments replicated thrice. The treatment with application of 3 Irrigations (25,45,70 DAS) + panchagavya-3% recorded significantly higher number of pods per

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plant (20.33), number of kernels per pod (2.47), seed index (39.84 g), pod yield (2.85 t/ha), haulm yield (4.4 t/ha) gross returns (1,61,808.4 INR), net returns (1,08,262.20 INR) and B:C ratio (2.02) compared to other treatment combinations.

Keywords: Groundnut; irrigation scheduling; panchagavya; jeevamrutha; panchamrutha yield; economics.

1. INTRODUCTION

"A common leguminous crop grown across the tropics and subtropics is groundnut (*Arachis hypogaea L*.). It is valued for its high-oil edible seeds, making it the third-most significant source of vegetable protein in the world and the fourth-most significant source of edible oil. Groundnut is not only an important oilseed crop of India but also an important agricultural export commodity. India ranks first in Groundnut acreage and is the second largest producer of Groundnut in the world with 67 lakh tonnes after China with a productivity of 1422 kg per hectare" (FAOSTAT, 2019). Although groundnut is grown in one or more of the seasons (kharif, rabi, and summer), the kharif crop accounts for roughly 80% of the acreage and production (June-October). A significant oilseed crop, groundnut will provide about 37% of the nation's total oilseed production in 2020–21. Groundnut acreage in the nation varies with time, and in the last 20 years, it has decreased from 83 lakh ha to 47 lakh ha as farmers switch to other lucrative crops in response to the green revolution, which mostly focused on cereal crops.

"Irrigation plays a major role in crop growth and development. Irrigation also affects the availability of plant nutrients, with proper irrigation to the crop at right time and right intervals maximum growth and yield can be achieved. Both excess and shortage of water can affect crop growth and yield adversely. Being a day neutral crop, ample irrigations are required by groundnut in summer and missing any irrigation at any one of the critical growth stages results into considerable reduction in pod yield. High soil moisture results in pod rot, low yield and poor seed quality and also water stress reduces photosynthesis mainly due to reduction in photosynthetic area". Madhuri Devi T, et al. [1]. Hence proper research is required to find proper irrigation scheduling.

Excessive use of Chemical fertilizers in agriculture after green revolution led to soil, water, environmental pollution along with health hazards. Organic liquid manures have variety of advantages over synthetic chemicals and supply all the essential plant nutrients in balanced manner naturally without deteriorating the soil health. Sustainable farming using organic inputs is essential to reduce the effects of synthetic fertilizers on soil health, the environment, and the preservation of ecological biodiversity. Hence this research is involved to find proper irrigation scheduling along with foliar application of liquid organic manures in summer ground nut.

2. MATERIALS AND METHODS

A field experiment was conducted during *summer* season of *2022* at Crop Research Farm (CRF), Department of Agronomy, SHUATS, Prayagraj (UP). The soil of the experimental plot is sandy loam in texture, nearly neutral in soil reaction (pH 7.4) (Glass electrode pH meter), medium in organic carbon (0.48%) (Walkley and Black Method), medium in available Nitrogen (278.93 kg/ha) (Alkaline Permanganate Method), low in available Phosphorous (19.03 kg/ha) (Olsen's Colorimetric Method) and medium in available Potash (238.1 kg/ha) (Flame Photometer Method). The treatments consist of three Irrigation Schedulings viz., I_1: 3 Irrigations (25,45,70 DAS), I_2: 2 Irrigations (25,45 DAS), I_3: 2 Irrigations (25,70 DAS) and three Foliar Organic Nutrition F1 – Panchagavya at 3%, F2 – Jeevamrutha at 3%, F3 – Panchamrutha at 3% whose effect is observed on Groundnut (var. Kadiri -6). The plot size of each treatment is $9m^2$. "The liquid organic manures helps to achieve higher growth and development of the crops through improved physiological and biochemical processes of the plant, as their application results in rapid availability of macronutrients, micronutrients, growth regulators and other beneficial substances to the plants in addition to enhanced tolerance to biotic and abiotic stresses. They also increase the beneficial microflora of the soil and their activity to a large extent upon soil application and thereby increase the availability of soil nutrients". K. N. Manoj et al. [2]. "The experiment was laid out in Randomized Block Design with ten treatments replicated thrice. The experiment comprising ten treatment possible combination of above factor, and are represented in Table 1. Observations regarding

growth and yield attributes was recorded during the field experiment".

3. RESULTS AND DISCUSSION

3.1 Yield Attributes

According to the yield characteristics data that was collected and analysed at harvest, maximum number of pods per plant (20.33), maximum number of kernels per pod (2.47) and higher seed index (40.08g) was recorded in treatment with the application of 3 Irrigations (25,45,70 DAS) + panchagavya-3%.

The improved performance of yield attributes may be due to increase in soil moisture reduces soil strength and facilitates easy movement of pods into the ground either throughout the growing period of crop or during critical period of peg formation and penetration, pod initiation, therefore increased the values of yield attributes. These findings are closely in line with those of BN Solanke et al. [3], Bibhu Santosh Behera et al. [4].

3.2 Yield

After evaluated the data recorded post harvesting of crop show that significantly higher pod yield (2.47 t/ha), higher haulm yield (4.4 t/ha) and harvest index (39.31%) was recorded in treatment with the application of 3 Irrigations (25,45,70 DAS) + panchagavya-3%.

The quantity of IAA and GA present in panchagavya spray as well as the simplicity with which nutrients may be applied to plants by foliar spray may have stimulated the plant system, increasing the production of growth regulators in the cell system. Consequently, this encouraged the necessary growth and development in plants, improving yield. These results are in close conformity with the findings of Ravi Kumar et al., [5], Vikash et al., [6], [7-13].

Table 1. Details of treatment combination

Sl. No.	Treatment No.	Treatments combination
1	T_1	3 Irrigations (25,45,70 DAS) + panchagavya-3%
2	T_2	3 Irrigations (25,45,70 DAS) + Jeevamrutha-3%
3	T_3	3 Irrigations (25,45,70 DAS) + Panchamrutha-3%
4	T_4	2 Irrigations (25,45 DAS) + panchagavya-3%
5	T_5	2 Irrigations (25,45 DAS) + Jeevamrutha-3%
6	T_6	2 Irrigations (25,45 DAS) + Panchamrutha-3%
7	T_7	2 Irrigations (25,70 DAS) + Panchagavya-3%
8	T_8	2 Irrigations (25,70 DAS) + Jeevamrutha-3%
9	T_9	2 Irrigations (25,70 DAS) + Panchamrutha-3%
10	T_{10}	Control

Table 2. Yield attributes of groundnut as influenced by irrigation scheduling and liquid organic manures

Treatment	Yield attributes		
	No. of pods/ plant	No. of kernels/ pod	Seed Index (g)
3 Irrigations (25,45,70 DAS) + panchagavya-3%	20.33	2.47	39.84
3 Irrigations (25,45,70 DAS) + Jeevamrutha-3%	19.67	2.27	38.70
3 Irrigations (25,45,70 DAS) + Panchamrutha-3%	19.53	2.07	38.95
2 Irrigations (25,45 DAS) + panchagavya-3%	18.87	2.00	38.91
2 Irrigations (25,45 DAS) + Jeevamrutha-3%	18.40	1.87	38.74
2 Irrigations (25,45 DAS) + Panchamrutha-3%	18.27	1.73	38.65
2 Irrigations (25,70 DAS) + panchagavya-3%	18.13	1.60	38.15
2 Irrigations (25,70 DAS) + Jeevamrutha-3%	17.53	1.60	38.14
2 Irrigations (25,70 DAS) + Panchamrutha-3%	17.47	1.60	38.14
Control	15.47	1.40	36.54
F test	S	S	NS
SEm(±)	0.06	0.05	0.56
CD (p=0.05)	0.19	0.14	--

Table 3. Yield of groundnut as influenced by irrigation scheduling and liquid organic manures

Treatment	Pod Yield (t/ha)	Haulm Yield (t/ha)	Harvest Index (%)
3 Irrigations (25,45,70 DAS) + panchagavya-3%	2.85	4.40	39.31
3 Irrigations (25,45,70 DAS) + Jeevamrutha-3%	2.76	4.28	39.24
3 Irrigations (25,45,70 DAS) + Panchamrutha-3%	2.55	4.26	37.42
2 Irrigations (25,45 DAS) + panchagavya-3%	2.36	4.22	35.84
2 Irrigations (25,45 DAS) + Jeevamrutha-3%	2.27	4.17	35.21
2 Irrigations (25,45 DAS) + Panchamrutha-3%	2.20	4.13	34.74
2 Irrigations (25,70 DAS) + panchagavya-3%	2.19	3.88	36.02
2 Irrigations (25,70 DAS) + Jeevamrutha-3%	2.12	3.76	36.08
2 Irrigations (25,70 DAS) + Panchamrutha-3%	2.09	3.58	36.84
Control	1.99	3.37	37.11
F test	S	S	S
SEm(±)	0.01	0.01	0.13
CD (p=0.05)	0.04	0.02	0.38

Table 4. Economics of groundnut at harvest as influenced by irrigation scheduling and liquid organic manures

S. No	Treatments	Economics			
		Cost of cultivation	Gross returns	Net returns	B:C ratio
1.	3 Irrigations (25,45,70 DAS) + panchagavya-3%	53,546.2	161808.4	108,262.20	2.02
2.	3 Irrigations (25,45,70 DAS) + Jeevamrutha-3%	54,446.2	124378.5	69,932.30	1.82
3.	3 Irrigations (25,45,70 DAS) + Panchamrutha-3%	54,746.2	114721.5	59,975.30	1.58
4.	2 Irrigations (25,45 DAS) + panchagavya-3%	53,046.2	106059	53,012.80	1.47
5.	2 Irrigations (25,45 DAS) + Jeevamrutha-3%	53,946.2	102012	48,065.80	1.33
6.	2 Irrigations (25,45 DAS) + Panchamrutha-3%	54,246.2	98869.5	44,623.30	1.25
7.	2 Irrigations (25,70 DAS) + Panchagavya-3%	53,046.2	98424	45,377.80	1.29
8.	2 Irrigations (25,70 DAS) + Jeevamrutha-3%	53,946.2	95470.5	41,524.30	1.18
9.	2 Irrigations (25,70 DAS) + Panchamrutha-3%	54,246.2	94042.5	39,796.30	1.14
10.	Control	51,546.2	89391	37,844.80	1.14

**Data was not subjected to statistical analysis*

3.3 Economics

The economic return of Groundnut was analyzed after harvesting the crop based on market pricing, the result indicated a growing trend in with the increasing yield trend across treatment.

The maximum Gross returns (INR 1,61,808.4*/*ha), Net returns (INR 1,08,262.20*/*ha) and Benefit cost ratio (2.02) was evaluated in treatment with the application of 3 Irrigations (25,45,70 DAS) + panchagavya-3%.

4. CONCLUSION

It is concluded that application of 3 Irrigations (25,45,70 DAS) and panchagavya-3% accomplished better growth and yield parameters and higher economic returns in Groundnut crop.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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