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Effects of super absorbent polymer and combining plant growth promoting rhizobacteria and chemical nitrogen fertilizer under irrigation management of peanut (Arachis hypogaea L.)

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ABSTRACT

Correct management for using microbial species of symbiotic with plants and application super absorbent polymer especially in dry farm would be effective in improvement their yield and quality. For evaluation effects of super absorbent polymer and combining plant growth promoting rhizobacteria and chemical nitrogen fertilizer under limited irrigation water management on yield and yield components, a factorial split-plot experiment was carried out, based on randomized complete block design with three replicas in Astaneh Ashrafiyeh region/North of Iran, in 2011 farming year. Treatments in research included main plot was consisted of water regimes treatments (I1=dry land and I2=12 day Interval Irrigation) and sub factor was consisted of combination treatments of super absorbent polymer (S1= 0 and S2= 200 kg ha-1), combining plant growth promoting rhizobacteria and chemical nitrogen fertilizer (N1=0, N2= Azospirillum + Azotobacter, N3= 30 kg N per ha + Aazospirillum + Azotobacter, N4= 60 kg N per ha + Aazospirillum + Azotobacter and N5= 90 kg N per ha + Aazospirillum + Azotobacter) were performed Results show that irrigation water management ($P<0.05$), application of super absorbent polymer ($P<0.01$), combining plant growth promoting rhizobacteria and different levels of chemical nitrogen fertilizer ($P<0.01$) had a significant effect on seed yield. The highest seed yield were found to be on 12 day interval irrigation (2750 kg/ha), application of 200 kg/ha super absorbent polymer (2755 kg/ha) and application 30 kg N per ha + Aazospirillum + Azotobacter (3593 kg/ha).

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INTRODUCTION

Peanut is one of the most important and economical oilseeds in tropical and subtropical regions and is mostly cultivated owing to its oil, protein and carbohydrate [23]. Peanut cultivation in Iran is done in Guilan, Golestan and Khuzestan provinces. In Guilan province, it is mainly cultivated in Astaneh-ye Ashrafieh county along Sepidroud river.

In arid and semiarid regions of Iran, serious water deficits and deteriorating environmental quality are threatening agricultural productivity and environmental sustainability. The available water in soil is one of the most important factors of increasing crop yields [9]. Deficit irrigation is an optimum technique for producing products under drought stress that is with decrease of products per area and increase of them with extent of area. Given the large share of water use in the agriculture sector and very low efficiencies in this sector, selection and development of the new strategies to improve and optimize irrigation water use with significant savings in this sector is essential. The usage of deficit irrigation and Superabsorbent polymers are the useful strategies in this regard [15, 24]. Many arid and semi arid regions are facing the problems of uncertain and inadequate rain fall. Spatially diversified soil characteristics, shortage of large agricultural lands and underprivileged condition of farmers do not allow them to adopt advantageous and economical application of traditional irrigation methods as well as micro irrigation techniques (drip and sprinkler irrigation). Though, not much research in India has been undertaken on the use of Super Absorbent Polymers (SAP) in agriculture, the researchers world over (specifically Iran, China, Europe and USA) have extensively worked on utilizing SAP for increasing water use

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efficiency and enhancing crop yield. Various studies have strongly recommended that soil conditioning with Super Absorbent Polymers could be an innovative facet in the field of agriculture, which works as miniature water storage reservoirs. Research evidences suggest that problems associated with traditional micro irrigation and the factors which are catalyst in practicing efficient irrigation techniques can be taken care of by conditioning the soil with SAP. Better water management can be attained with the application of polymers and considerable water saving can be done without compromising the crop yield. Present literature review has been conducted to have a quick access in understanding various properties of Super Absorbent Polymers (SAP, Hydro-gels, and Polymers) to be used in agriculture. Science of SAP, hydrophilic property, irrigation efficiency, effects under drought stress, effects over the morphological features of the plant, optimum use of fertilizers, biodegradability and application rates under different condition are thoroughly reviewed. The present review would provide an initiative for the experimental research on use of SAP and its rate of application to optimize water use efficiency and the yield of cash crops in arid and semi-arid regions [7].

Nitrogen gain through organic material mineralization is a critical issue for regional soils to overcome nitrogen deficiency. Various fertilization implementations (chemical, manure) or bacteria inoculation with proper strains should be carried out to improve the soil fertility and corresponding yield values. High chemical fertilizer costs and low income levels of regional farmers limit the fertilizer use of farmers. External dependence increases fertilizer prices each year and such an increase will probably continue in upcoming years. Intensive fertilizer use for high yield increases production costs. Precipitation dependency of mineral nitrogenous fertilizers [3, 8] easy leaching of such fertilizers and consequent environmental and water pollution [6] all indicate that productivity of agricultural lands is not totally dependent on chemical fertilizers [13]. Research has shown that due to quick nitrogen loss in many different ways plants only get a small portion of nitrogenous fertilizers applied to soil [25]. Environmentally friendly production systems are gaining in popularity to overcome the negative aspects of traditional production techniques with intensive inputs [13]. Organic and sustainable agricultural practices have become more widespread around the world [19]. Bioorganic systems play crucial roles in the development and implementation of sustainable agricultural techniques [26]. Biofertilizers application not only increases plants growth and yield, but increase soil microbial population and activity; resulting in improved soil fertility [5]. Biofertilizers consist of various types of microorganisms. There are some microorganisms in soil which are in close relation with plant roots and are called Plant growth Promoting rhizobacteria (PGPR). They include free-living bacteria which promote plant growth even in polluted soils. Azospirillum, Azotobacter, Pseudomonas, Bacillus and Thiobacillus are examples of these bacteria [31, 35]. The goal of this study is evaluation the effect of combining chemical and biological fertilizers and superabsorbent under irrigation management on yield and yield components in peanut to identify suitable biological fertilizers in sustainable agriculture and reducing the costs of production of crops and saving environment.

MATERIALS AND METHODS

For evaluation effects of super absorbent polymer and combining plant growth promoting rhizobacteria and chemical nitrogen fertilizer under limited irrigation water management on yield and yield components, a factorial split-plot experiment was carried out, based on randomized complete block design with three replicas in Astaneh Ashrafiyeh region/North of Iran, in 2011 farming year. Treatments in research included main plot was consisted of water regimes treatments (I1=dry land and I2=12 day Interval Irrigation) and sub factor was consisted of combination treatments of super absorbent polymer (S1= 0 and S2= 200 kg ha-1), combining plant growth promoting rhizobacteria and chemical nitrogen fertilizer (N1=0, N2= Azospirillum + Azotobacter, N3= 30 kg N per ha + Aazospirillum + Azotobacter, N4= 60 kg N per ha + Aazospirillum + Azotobacter and N5= 90 kg N per ha + Aazospirillum + Azotobacter) were performed. Measured traits in this study were consist of Seed Yield, Pod yield, Biomass yield, Harvest index, Number of pod per plant, Number of seed per plant, Plant height, 100 seed weight, Seed width, Seed length, Partitioning factor, Pod Growth Rate, Crop Growth Rate and Water use efficiency (WUE) Pod.

Also to determine the crop growth rate, pod growth rate and partitioning factor equations were used [33]:

CGR= Haulm yield + (pod yield×1.65)/T1

PGR= (pod yield×1.65)(T1-T2-15)

T1 is the number of days from sowing to harvest and T2 is the duration from sowing to 50% flowering. Shelling percentage was calculated by dividing of seed weight to pod weight.

PF= PGR/CGR.

Water use efficiency (kg/m3) was determined based on the ratio of the yield to the water applied during the irrigation season as follow [10]:

WUE= Total yield/the volume of applied irrigation water.

In the last part of this study, the economic indices analysis for eggplant production was investigated. Gross value of production, total cost of production, net return, benefit to cost ratio and productivity were calculated using the following equations [4]:

$$\text{Gross value of production } (\$\ \text{ha}^{-1}) = \text{Yield } (\text{kg ha}^{-1}) \times \text{Sale price } (\$\ \text{kg}^{-1})$$

$$\text{Net return } (\$\ \text{ha}^{-1}) = \text{Gross value of production } (\$\ \text{ha}^{-1}) - \text{Total cost of production } (\$\ \text{ha}^{-1})$$

$$\text{Productivity (kg/\$)} = \frac{\text{Yield (kg/ha)}}{\text{Total cost of production (\$/ha)}}$$

$$\text{Benefit to cost ratio} = \frac{\text{Gross value of production } (\$\ \text{ha}^{-1})}{\text{Total cost of production } (\$\ \text{ha}^{-1})}$$

The data were analyzed by using SAS software. The Duncan's multiple range tests was used to compare the means at 5% of significant.

RESULT AND DISCUSSION

According to variance analysis table (Table 1), Results show that irrigation water management (P<0.05), application of super absorbent polymer (P<0.01), combining plant growth promoting rhizobacteria and different levels of chemical nitrogen fertilizer (P<0.01) had a significant effect on seed yield. The highest seed yield were found to be on 12 day interval irrigation (2750 kg/ha), application of 200 kg/ha super absorbent polymer (2755 kg/ha) and application 30 kg N per ha + Aazospirillum + Azotobacter (3593 kg/ha) (Table 2). According to variance analysis table (Table 1), Results show that irrigation water management (P<0.01), application of super absorbent polymer (P<0.01), combining plant growth promoting rhizobacteria and different levels of chemical nitrogen fertilizer (P<0.01) had a significant effect on pod yield. The highest pod yield were found to be on 12 day interval irrigation (4719 kg/ha), application of 200 kg/ha super absorbent polymer (4783 kg/ha) and application 30 kg N per ha + Aazospirillum + Azotobacter (6092 kg/ha) (Table 2). According to variance analysis table (Table 1), Results show that irrigation water management (P<0.05), application of super absorbent polymer (P<0.01), combining plant growth promoting rhizobacteria and different levels of chemical nitrogen fertilizer (P<0.01) had a significant effect on biomass yield. The highest biomass yield were found to be on 12 day interval irrigation (13985 kg/ha), application of 200 kg/ha super absorbent polymer (14684 kg/ha) and application 30 kg N per ha + Aazospirillum + Azotobacter (15002 kg/ha), application 60 kg N per ha + Aazospirillum + Azotobacter (14649 kg/ha), application 90 kg N per ha + Aazospirillum + Azotobacter (15247 kg/ha) (Table 2). According to variance analysis table (Table 1), Results show that irrigation water management (P<0.05), application of super absorbent polymer (P<0.01), combining plant growth promoting rhizobacteria and different levels of chemical nitrogen fertilizer (P<0.01) had a significant effect on harvest index yield. The highest harvest index were found to be on 12 day interval irrigation (32.04 %), application of 200 kg/ha super absorbent polymer (31.64 %) and application 30 kg N per ha + Aazospirillum + Azotobacter (39.62 %) (Table 2). According to variance analysis table (Table 1), Results show that irrigation water management (P<0.05), application of super absorbent polymer (P<0.01), combining plant growth promoting rhizobacteria and different levels of chemical nitrogen fertilizer (P<0.01) had a significant effect on plant height. The highest plant height were found to be on 12 day interval irrigation (70.99 cm), application of 200 kg/ha super absorbent polymer (67.15 cm) and application 90 kg N per ha + Aazospirillum + Azotobacter (83.96 cm) (Table 2). According to variance analysis table (Table 1), Results show that irrigation water management (P<0.05), application of super absorbent polymer (P<0.01), combining plant growth promoting rhizobacteria and different levels of chemical nitrogen fertilizer (P<0.01) had a significant effect on number of seed per plant. The highest number of seed per plant were found to be on 12 day interval irrigation (89.48), application of 200 kg/ha super absorbent polymer (88.03) and application 30 kg N per ha + Aazospirillum + Azotobacter (110.33) (Table 2). According to variance analysis table (Table 1), Results show that irrigation water management (P<0.05), application of super absorbent polymer (P<0.01), combining plant growth promoting rhizobacteria and different levels of chemical nitrogen fertilizer (P<0.01) had a significant effect on number of pod per plant. The highest number of pod per plant were found to be on 12 day interval irrigation (49.96), application of 200 kg/ha super absorbent polymer (52.80) and application 30 kg N per ha + Aazospirillum + Azotobacter (65.49) (Table 2). According to variance analysis table (Table 1), Results show that irrigation water management (P<0.05), application of super absorbent polymer (P<0.01), combining plant growth promoting rhizobacteria and different levels of chemical nitrogen fertilizer (P<0.01) had a significant effect on seed length. The highest seed length were found to be on 12 day interval irrigation (4.15 cm), application of 200 kg/ha super absorbent polymer (3.97 cm) and application 30 kg N per ha + Aazospirillum + Azotobacter (4.28 cm) (Table 2). According to variance analysis table (Table 1), Results show that irrigation water management (P<0.05), application of super absorbent polymer (P<0.01), combining plant growth promoting rhizobacteria and different levels of chemical nitrogen fertilizer (P<0.01) had a significant effect on seed width. The highest seed width were found to be on 12 day interval irrigation

(2.28 cm), application of 200 kg/ha super absorbent polymer (2.15 cm) and application 30 kg N per ha + Aazospirillum + Azotobacter (2.68 cm) (Table 2). According to variance analysis table (Table 1), Results show that irrigation water management ($P<0.01$), application of super absorbent polymer ($P<0.01$), combining plant growth promoting rhizobacteria and different levels of chemical nitrogen fertilizer ($P<0.01$) had a significant effect on 100 seed weight. The highest 100 seed weight were found to be on 12 day interval irrigation (38.37 g), application of 200 kg/ha super absorbent polymer (37.71 g) and application 30 kg N per ha + Aazospirillum + Azotobacter (41.88 g) (Table 2). According to variance analysis table (Table 1), Results show that irrigation water management ($P<0.05$), application of super absorbent polymer ($P<0.01$), combining plant growth promoting rhizobacteria and different levels of chemical nitrogen fertilizer ($P<0.01$) had a significant effect on WUE Pod. The highest WUE Pod were found to be on 12 day interval irrigation (2.05 kg/m^3), application of 200 kg/ha super absorbent polymer (1.73 kg/m^3) and application 30 kg N per ha + Aazospirillum + Azotobacter (2.18 kg/m^3) (Table 2). According to variance analysis table (Table 1), Results show that irrigation water management ($P<0.01$), application of super absorbent polymer ($P<0.01$), combining plant growth promoting rhizobacteria and different levels of chemical nitrogen fertilizer ($P<0.01$) had a significant effect on crop growth rate. The highest crop growth rate were found to be on 12 day interval irrigation (8.65 g/m^2.day), application of 200 kg/ha super absorbent polymer (8.69 g/m^2.day) and application 30 kg N per ha + Aazospirillum + Azotobacter (10.31 g/m^2.day) (Table 2). According to variance analysis table (Table 1), Results show that irrigation water management ($P<0.01$), application of super absorbent polymer ($P<0.01$), combining plant growth promoting rhizobacteria and different levels of chemical nitrogen fertilizer ($P<0.01$) had a significant effect on pod growth rate. The highest pod growth rate were found to be on 12 day interval irrigation (10.45 g/m^2.day), application of 200 kg/ha super absorbent polymer (10.32 g/m^2.day) and application 30 kg N per ha + Aazospirillum + Azotobacter (13.29 g/m^2.day) (Table 2). According to variance analysis table (Table 1), Results show that irrigation water management ($P<0.01$), application of super absorbent polymer ($P<0.01$), combining plant growth promoting rhizobacteria and different levels of chemical nitrogen fertilizer ($P<0.01$) had a significant effect on partitioning factor. The highest partitioning factor were found to be on 12 day interval irrigation (1.15 %), application of 200 kg/ha super absorbent polymer (1.14 %) and application 30 kg N per ha + Aazospirillum + Azotobacter (1.25 %) (Table 2).

Super absorbent polymers by increasing the capacity of water storage in soil [2, 28], reduction of wasting water and nutrition materials of soil [1], reduction of water evaporation from the surface of soil [2, 28, 29] and increasing the aeration of soil [22] causes the better growth and enlargement of plants and as a result, increase the yield under normal irrigation and water stress condition. The combination of super absorbent polymer and fertilizers, i.e., incorporating fertilizers and Superabsorbent polymers in a single formulation named as water-absorbent slow release fertilizer is a trend in international fertilizer research, [11,14,18,32,34,36]. Application of soil microorganisms as biological fertilizer is considered as the most natural and efficient solution for sustaining and activating soil bacterial life [27].The main advantages of the growth stimulant bacteria include production of growth regulating hormones, expansion of root network, improvement of water and nutrient absorption, enhancement of germination and seedling emergence [16], increase of phosphorus availability, development of synergy with rhizobia, biological fixation of nitrogen [12], and production of antibiotic agents, such as bacteriocins, for controlling plant disease agents [30] Consumption of biological fertilizers is considered as the most efficient soil management method to sustain soil quality at a favorable level [17]. Generally, biological fertilizers are microbial inoculants that induce nutrient availability through their biological mechanism. Biological fertilizers have been used as environmental-friendly inputs since the last decade. This resulted in reduction of the application of chemical fertilizers and improvement of soil fertility through biological activity in rhizosphere area [20].

Moraditochaee et al. [2013] with study effects zeolite and their combining bio-fertilizer and different levels of chemical nitrogen fertilizer under irrigation management on yield and yield components of Peanut (Arachis hypogaea L.) In north of Iran reported that, all traits (seed yield, pod yield, biomass yield and water use efficiency based on seed, water use efficiency based on pod and water use efficiency based on biomass) were significantly affected by applying the suggested treatments. The highest seed yield was found to be on 12 day interval irrigation (2561 kg/ha), application of 7 ton ha-1 zeolie (2726 kg/ha) and application of 30 kg N per ha + Aazospirillum + Azotobacter (2345 kg/ha). The highest water use efficiency based on seed was found to be on 12 day interval irrigation (1.88 kg/m^3), application of 7 ton ha-1 zeolie mineral (1.73 kg/m^3) and application 30 kg N per ha + Aazospirillum + Azotobacter (2.03 kg/m^3). Ziaeidoustan et al. [2013] with study the effects of different levels of irrigation interval, nitrogen and superabsorbent on yield and yield component of peanut reported that, irrigation interval and N fertilizer on all measured trait including seed yield, pod yield, number of seed per shrub, RWC and SCMR was significant at 1% probability level. Application of superabsorbent was significant on seed yield, pod yield and RWC at 1% and SCMR at 5% probability level. Interaction effect of Irrigation ×N and Irrigation and superabsorbent were significant on all measured trait at 1% probability level. Interaction of N fertilizer and superabsorbent was significant on pod yield and RWC at 1% probability level and the interaction of Irrigation interval and N fertilizer and superabsorbent was significant on pod yield and RWC at 1% and SCMR at 5% probability level. With attention to results of experiment, with increase nitrogen application up to 80 kg/h and decrease the Irrigation Interval up to 6 days and application of superabsorbent, all studied traits were increased.

According to economic analysis table (Table 3), Maximum gross value of production were obtained under 12 day interval irrigation (8524 $/ha), application of 200 kg/ha super absorbent polymer (8540 $/ha) and application 30 kg N per ha + Aazospirillum + Azotobacter (11139 $/ha) (Table 3). According to economic analysis table (Table 3), Maximum total cost of production were obtained under 12 day interval irrigation (3360 $/ha), application of 200 kg/ha super absorbent polymer (3994 $/ha) and application 90 kg N per ha + Aazospirillum + Azotobacter (3363 $/ha) (Table 3). According to economic analysis table (Table 3), Maximum net return were obtained under 12 day interval irrigation (5164 $/ha), application of 200 kg/ha super absorbent polymer (4546 $/ha) and application 30 kg N per ha + Aazospirillum + Azotobacter (7780 $/ha) (Table 3). According to economic analysis table (Table 3), Maximum Benefit to cost ratio were obtained under 12 day interval irrigation (0.82), application of 200 kg/ha super absorbent polymer (0.69) and application 30 kg N per ha + Aazospirillum + Azotobacter (1.07) (Table 3). According to economic analysis table (Table 3), Maximum productivity were obtained under 12 day interval irrigation (2.55 kg/ha), application of 200 kg/ha super absorbent polymer (2.14 kg/ha) and application 30 kg N per ha + Aazospirillum + Azotobacter (3.32 kg/ha) (Table 3).

Table 1: Analysis of variance (mean square and significance) for effects of super absorbent polymer and combining plant growth promoting rhizobacteria and chemical nitrogen fertilizer under irrigation management of Peanut

S.O.V	df	Seed Yield	Pod yield	Biomass yield	Harvest index	Plant height	Number of seed per plant	Number of pod per plant
Replication (R)	2							
Irrigation (I)	1	*	**	*	*	*	*	*
R×I	2							
super absorbent (S)	1	**	**	**	**	**	**	**
Nitrogen+Bacteria (N)	4	**	**	**	**	**	**	**
I×S	1							
I×N	4							
S×N	4							
I×S×N	4							
Error	36							
S.O.V	df	Seed length	Seed width	100 seed weight	WUE Pod	Crops Growth Rate	Pod Growth Rate	Partitioning coefficient
Replication (R)	2							
Irrigation (I)	1	*	*	**	*	**	**	**
R×I	2							
Super absorbent (S)	1	**	*	**	**	**	**	**
Nitrogen + Bacteria (N)	4	**	**	**	**	**	**	**
I×S	1							
I×N	4							
S×N	4							
I×S×N	4							
Error	36							

*and ** significant at level of 5 and 1%, respectively. Values that do not have any symbol are non-significant.

Table 2: Comparison of mean for effects of super absorbent polymer and combining plant growth promoting rhizobacteria and chemical nitrogen fertilizer under irrigation management of Peanut

Treatments	Seed Yield (Kg/ha)	Pod yield (Kg/ha)	Biomass yield (Kg/ha)	Harvest index (%)	Plant Height (cm)	Number of seed per plant (-)	Number of pod per plant (-)
Irrigation (I)							
I1	1864B	3328B	11167B	29.74B	59.75B	64.42B	40.44B
I2	2750A	4719A	13985A	32.04A	70.99A	89.48A	49.96A
super absorbent (S)							
S1	1561B	2733B	9653B	28.64B	60.19B	59.55B	33.93B
S2	2755A	4783A	14684A	31.64A	67.15A	88.03A	52.80A
Nitrogen + Bacteria (N)							
N1	1259C	2247C	7992C	28.78CB	53.50C	49.95C	31.37C

N2	1574C	2808C	9990B	28.78CB	60.69CB	52.58C	33.05C
N3	3593A	6092A	15002A	39.62A	60.69CB	110.33A	65.49A
N4	2760B	4893B	14649A	32.10B	68.02B	92.79AB	52.20B
N5	2349B	4078B	15247A	25.17C	83.96A	79.11B	43.88B
	Seed length (cm)	Seed width (cm)	100 seed weight (g)	WUE Pod (kg/m^3)	Crop Growth Rate (g/m^2.day)	Pod Growth Rate (g/m^2.day)	Partitioning factor (%)
Irrigation (I)							
I1	3.43B	1.83B	31.23B	1.93B	6.49B	7.04B	1.02B
I2	4.15A	2.28A	38.37A	2.05A	8.65A	10.45A	1.15A
super absorbent (S)							
S1	3.57B	1.98B	30.26B	0.90B	5.73B	6.03B	1.01B
S2	3.97A	2.15A	37.71A	1.73A	8.69A	10.32A	1.14A
Nitrogen + Bacteria (N)							
N1	3.36D	1.62C	28.90C	0.81C	4.81C	4.69C	0.94C
N2	3.53B	1.82C	30.42C	1.12C	5.80C	6.06C	1.02C
N3	4.28A	2.68A	41.88A	2.18A	10.31A	13.29A	1.25A
N4	4.01B	2.15B	37.44B	1.91B	8.90B	10.73B	1.16B
N5	3.78C	2.00B	35.35B	1.48B	8.03B	8.95B	1.05B

Means, in each column, with similar letters are not significantly different at the 5% probability level

Table 3: Economic analysis for effects of super absorbent polymer and combining plant growth promoting rhizobacteria and chemical nitrogen fertilizer under irrigation management of Peanut

Treatments	Gross value of production ($/ha)	Total cost of production ($/ha)	Net return ($/ha)	Benefit to cost ratio	Productivity (kg/ha)
Irrigation (I)					
I1	5780	3358	2421	0.56	1.72
I2	8524	3360	5164	0.82	2.54
super absorbent (S)					
S1	4840	2724	2116	0.57	1.78
S2	8540	3994	4546	0.69	2.14
Nitrogen + Bacteria (N)					
N1	3903	3355	547	0.38	1.16
N2	4879	3357	1521	0.47	1.45
N3	11139	3359	7780	1.07	3.32
N4	8555	3361	5194	0.82	2.55
N5	7283	3363	3920	0.70	2.17

Conclusion:

True irrigation management with super absorbent polymer application and proper usage of amount of nitrogen combining plant growth promoting rhizobacteria and chemical nitrogen fertilizer lead to increase in groundnut growth, because by this process, level of leaves will develop and less light penetrate into soil. Therefore due to direct relation between plant growth rate and light absorption by canopy of plant, light absorption increase lead to increase in plant and crop growth rate. Application of bio fertilizer containing bacterial micro organisms with water and food storing materials called super absorbent materials causes improving the growth and yield in peanut and since this plant is cultivated as dry farm in north of Iran, application these materials is an appropriate methodfor improvingthe yield andquality characteristics oftheused land. Meanwhile, using of fixation biological fertilizers provides required nutrients for the plant and biological fixation of these elements and reducing their deficiency as well as improving their yields and less pollution of the soil and water.

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