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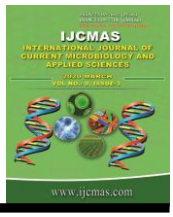

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Productivity Dynamics of Groundnut as Influenced by Different Plant Densities and Fertilizer Levels During Summer Season

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A B S T R A C T

An experiment entitled Productivity dyanamics of groundnut as influenced by different plant densities and fertilizer levels during *summer* season was carried out during *summer* season of 2015 at the farm of Oilseed Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.). The treatments comprised of three spacing 30 x 10 cm, 25 x 10 cm and 20 x 10 cm and three fertilizer levels 75%, 100% and 125% RDF ha^{-1}. The experiment was laid out in a factorial randomized block design (FRBD) with three replications. Among three spacing, 30 x 10 cm was superior over 20 x 10 cm in respect of plant height (cm), number of branches $plant^{-1}$, plant spread (cm), number of root nodules $plant^{-1}$,dry matter accumulation $plant^{-1}$ (g), haulm yield (kg ha^{-1}). Treatment 20 x 10 cm was superior over 30 x 10 cm in respect to pod yield (3038 Kg ha^{-1}), biological yield (6993 kg ha^{-1}) and Harvest index (42.50%). The growth and yield attributes showed significantly increased when use of 125 % RDF ha^{-1}. Pod yield (2809 Kg ha^{-1}), haulm yield (4248 Kg ha^{-1}) obtained was significantly higher at application of 125 % RDF ha^{-1} than 75 % and 100 % RDF ha^{-1}. Use of 125% RDF ha^{-1} was found to most economical than 75 % and 100 % RDF.

Introduction

Groundnut (*Arachis hypogea* L.) or peanut commonly called as poor man`s nut is an important oilseed cum legume crop of India. Groundnut belongs to C_3 plant, it needs good sunshine and high temperature to produce more pods. India ranks second in production of groundnut after China. At the global level, 50 per cent of the groundnut produced is used for oil extraction, 37 per cent for confectionary and 12 per cent for seed purpose.

Where as in India, 80 per cent of the groundnut produced is used for oil extraction, 11 per cent as seed, 8 per cent used as direct food and only 1 per cent of groundnut is exported. The by-product of this crop like haulm is rich in protein content (10-12 %) and

used as nutritious feed for cattle. As groundnut belongs to fabaceae family which maintains the soil fertility by fixing the atmospheric nitrogen which fulfils its requirement. According to the national economic survey, Indian adult could consume 7.2 kg $year^{-1}$ $capita^{-1}$ i.e. 20 g oil per day against 55 g day^{-1} $capita^{-1}$ in western countries.

The growth rate of oilseed crops in terms of production was much higher after 1980's as compared to other crops with the introduction of technology mission on oilseeds (TMO) in 1986 and it brought "Yellow Revolution'' in oilseed crops in India. Groundnut is a cash crop and it is useful for crop rotation. It is easy to grow, withstand drought to some extent and hence a choice crop for dry farming.

It is a soil erosion resisting crop. Being leguminous crop it can fix atmospheric nitrogen with the help of symbiotic relationship of bacteria in root nodules and there by reduces fertilizer requirement of succeeding crop. Thus maintain soil fertility. All parts of the plant can be commercially used. Commercially and nutritionally it is a very important source of oil. Groundnut contains 13 different vitamins (including A, the B group C and E) along with 26 essential trace minerals, including calcium and iron.

Materials and Methods

The field experiment was conducted during *summer* season of 2015 at the Oilseed Research Unit, Dr. Panjabrao Deshmukh Krishi Vidhyapeeth, Akola during *summer* 2014-15. The topography of the experimental field was uniform leveled and well drained. The meteorological data indicated that the maximum temperature ranged between 23.7°C to 42.9°C and was observed at 1th and 19th meteorological week.

Whereas, minimum temperature ranged from 11.0°C to 27.8°C and it was registered at 1th and 21thmeteorological week respectively. The total rainfall of 80.02 mm was received in 6 rainy days during the experimentation. The minimum and maximum sunshine hours was ranged from 8.2 to 9.8 hours.

The maximum and minimum wind velocity also ranged from 4.2 to 90 km hr^{1} during the period of experiment. The assured irrigation facilities were therefore needed for growing crops during *summer*. The soil of experimental site was clay loam in texture, low in available nitrogen (146 kg ha^{-1}), medium in available phosphorus (16 kg ha^{-1}) and fairly rich in available potassium (290 kg ha^{-1}).

The soil was moderately alkaline in reaction (pH 8.1) with EC (0.45 dSm^{-1}). It was moderately high in organic carbon. The experiment was laid out in Factorial Randomized Block design with three replications. Nine treatment combinations were formed with a view to integration of three planting densities and three fertilizer levels.

TAG-24 variety was used for sowing. The groundnut kernels were treated with biofertilizers like *Rhizobium* and PSB culture @ 250 g per 10 kg seeds. Single seed was dibble $hill^{-1}$ by maintaining spacing according to treatments *viz.*, 30 cm x 10 cm (PP @ 3.33 lakh ha^{-1}), 25 x 10 cm (PP @ 4.00 lakh ha^{-1}) and 20 x 10 cm (PP @ 5.00 lakh ha^{-1}) and three fertilizer levels 75%, 100% and 125% RDF ha^{-1}. The lines were marked with the help of marker and sowing of the crop was done on 21th January, 2015.

The recommended dose of fertilizer i.e. 25 kg N through urea and 50 Kg P_2O_5 ha-^{1} through single super phosphate and 30 kg K through muriate of potash was applied as a basal dose.

The correct quantity to be applied in each treatment was calculated on the basis of nutrient content of fertilizer used.

Results and Discussion

Plant population

The initial and final (at harvest) plant stand ha^{-1} as influenced by various treatments are compiled in Table 1.

Effect of planting densities

The plant population under study exhibited significant difference amongst themselves at initial stage and at harvest. However, these differences due to different plant spacing.

Effect of fertilizer levels

The plant population under study neither exhibited significant difference at initial stage nor at harvest due to different fertilizer levels.

Growth attributes

The data pertaining to mean growth attributes of groundnut as influenced by different treatments at harvest during *summer* 2015 are presented in Table 2.

Effect of plant densities

The growth attributes viz., plant height (cm), plant spread (cm), number of branches $plant^{-1}$, number of nodules $plant^{-1}$ and dry matter $plant^{-1}$ (g) were found to be significant difference due to plant densities at harvest. In S_1 spacing (30 x 10 cm) verified maximum growth attributes viz., plant height (15.81 cm), plant spread (32.04 cm), number of branches $plant^{-1}$ (6.15), number of nodules $plant^{-1}$ (25.78) and dry matter $plant^{-1}$ (24.25 g) which was significantly superior over spacing S_2 (25 x 10 cm) and spacing S_3 (20 x 10 cm).

The increase in growth attributes in S_1 spacing (30 x10 cm) might be due to less plants competition for nutrients, water and space. Denser plant population has less availability of macro and micro nutrients and hence less plant height as compare to low plant population. Above results are in agreement with findings of Migawer *et al.*, (2000) and Kausale *et al.*, (2002)

Effect of fertilizer levels

The growth attributes viz., plant height (cm), plant spread (cm), number of branches $plant^{-1}$, number of nodules $plant^{-1}$ and dry matter $plant^{-1}$ (g) were not found significant at harvest stages. However numerically high value of growth attributes viz., plant height (15.06 cm), plant spread (31.08 cm), number of branches $plant^{-1}$(5.87), number of nodules $plant^{-1}$ (26.56) and dry matter $plant^{-1}$ (24.12 g) was recorded with treatment F_3 (125% RDF) and treatment F_1 (75 % RDF) recorded minimum growth attributes viz., plant height (14.68 cm), plant spread (29.85 cm), number of branches $plant^{-1}$(5.42), number of nodules $plant^{-1}$ (25.78) and dry matter $plant^{-1}$ (23.63 g). Similar results were reported by Sable (2002), Thakre *et al.*, (2003) and Throve and Dhonde (2007).

Effect of planting densities

The yield of groundnut viz., pod yield (kg ha^{-1}), haulm yield (kg ha^{-1}), biological yield (kg ha^{-1}) and harvest index due to different planting densities was found to be significant at harvest. The crop grown with spacing S_3 (20 x 10 cm) shows more yield of groundnut viz., pod yield (3038 kg ha^{-1}), biological yield (6993 kg ha^{-1}) and harvest index (42.58 %)than other treatments of spacing viz., S_2 (25 x 10 cm) and the crop grown with spacing S_1 (30 x 10 cm). This might be happened due to the effect of planting densities, high plant densities has more number of plant as

compare to low plant densities and hence per plant yield may be less but due to the effect of high plant density per hectare yield was recorded more. The haulm yield kg ha^{-1} due to different planting densities was found to be significant at harvest. The crop grown with treatment S_1 (30 x 10 cm) recorded significantly highest haulm yield (4391 kg ha^{-1}) than spacing S_2 and spacing S_3 which was at par with each other. This might be happened due to the effect of planting densities, high plant densities has more competition for nutrients and hence less dry matter accumulation per plant takes place per hectare as compare to low plant densities. Above results obtained are in agreement with the findings of Rama Jyoti *et al.,* (2004) and Ghosh *et al.,* (2005).

Effect of fertilizer levels

The yield of groundnut viz., pod yield (kg ha^{-1}), haulm yield (kg ha^{-1}) and biological yield (kg ha^{-1}) due to the different fertilizer levels was found significant at harvest. The treatment F_3 (125 % RDF) recorded more yield of groundnut viz., pod yield (2809 kg ha^{-1}), haulm yield (4248 kg ha^{-1}) and biological yield (7001 kg ha^{-1}) and found significantly superior over F_1 (75 % RDF) and F_2 (100 % RDF). Treatment F_1 (75 % RDF) recorded minimum yield of groundnut viz., pod yield (2376 kg ha^{-1}), haulm yield (4059 kg ha^{-1}) and biological yield (6435 kg ha^{-1}).

This might be due to less availability of nutrients in treatment F_1 as compare to treatment F_3 and hence shows less pod yield kg ha^{-1}. Above results obtained are in agreement with the findings of Rajnikanth *et al.,* (2008), Elayraja and Singarvel (2009) and Karunakaran *et al.,* (2010). The harvest index due to different fertilizer levels was found to be non-significant. However, the crop grown with treatment F_3 (125 % RDF) shows more value of harvest index (39.22 %). Treatment F_1 (75 % RDF) shows less value of harvest index (36.86 %).

This might be happened due to the effect of different doses of fertilizer, high fertilizer levels has more availability of nutrients as compare to low fertilizer levels and hence results in maximum dry matter production per plant and ultimately more dry matter production per hectare results in more biological yield and harvest index in high fertilizer levels**.** Above results obtained are in agreement with the findings of Nwokwu (2006).

Table.1 Emergence and final plant stand ha^{-1} as influenced by different treatments

Treatments	Plant count (ha^{-1})	
	Initial	Final
Planting densities		
S_1 – 30 x 10 cm (3.33 lakh ha^{-1})	327513	321825
S_2 – 25 x 10 cm (4 lakh ha^{-1})	378968	373015
S_3 – 20 x10 cm (5 lakh ha^{-1})	478703	472222
S.E. (m) ±	4606	4995
C D at 5 %	13810	14977
Fertilizer levels		
F_1 – 75 % of RDF	388227	381481
F_2 – 100 % of RDF	400132	393518
F_3 – 125 % of RDF	396825	392063
S.E. (m) ±	4606	4995
C D at 5 %	NS	NS

Table.2 Mean growth attributes of groundnut as influenced by different treatments at harvest

Treatments	Growth attributes				
	Plant height (cm)	Plant spread (cm)	No. of branches Plant^{-1}	No of nodules Plant^{-1}	Dry matter Plant^{-1} (gm)
Planting densities					
S_1 – 30 x 10 cm (3.33 lakh ha^{-1})	15.81	32.04	6.15	25.78	24.25
S_2 – 25 x 10 cm (4 lakh ha^{-1})	14.94	29.38	5.90	25.67	24.19
S_3 – 20 x10 cm (5 lakh ha^{-1})	14.02	28.31	4.87	25.00	23.02
S.E. (m) ±	0.15	0.29	0.19	0.49	0.19
C D at 5 %	0.44	0.86	0.56	NS	0.56
Fertilizer levels					
F_1 – 75 % of RDF	14.68	29.85	5.42	25.78	23.63
F_2 – 100 % of RDF	15.03	30.80	5.63	24.11	23.71
F_3 – 125 % of RDF	15.06	31.08	5.87	26.56	24. 12
S.E. (m) ±	0.15	0.29	0.19	0.49	0.19
C D at 5 %	NS	NS	NS	NS	NS

Table.3 Mean yield of groundnut as influenced by different treatments at harvest

Treatments	Pod yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Biological yield (kg ha^{-})	Harvest index
Planting densities				
S_1 – 30 x 10 cm (3.33 lakh ha^{-1})	2275	4391	6667	34.09
S_2 – 25 x 10 cm (4 lakh ha^{-1})	2479	4135	6615	37.40
S_3 – 20 x10 cm (5 lakh ha^{-1})	3038	4009	6993	42.58
S.E. (m) ±	83.69	48.11	111.92	0.83
C D at 5 %	250.90	144.23	335.76	2.48
Fertilizer levels				
F_1 – 75 % of RDF	2376	4059	6435	36.86
F_2 – 100 % of RDF	2608	4229	6838	37.99
F_3 – 125 % of RDF	2809	4248	7001	39.22
S.E. (m) ±	83	48	111.92	0.83
C D at 5 %	250.90	144.23	335.55	NS

The growth and yield attributes found maximum when crop grown with spacing S_1 30 cm x 10 cm (Plant Population @ 3.33 lakh ha^{-1}) over other plant spacing. The growth and yield attributes recorded maximum with treatment F_3 (125 % RDF).

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