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RESEARCH ARTICLE

Effect of mulching, hydrogel and nutrient management on productivity of summer groundnut

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ABSTRACT : A field experiment was conducted at the AICRP on Groundnut, Bhubaneswar Centre of Orissa University of Agriculture and Technology, Bhubaneswar during *Rabi*-Summer,2013-14 in a split-plot design with three replications two mulching practices (With biodegradable mulch and Without biodegradable mulch) in the main plot sown with three hydrogel levels (Control(Irrigation as per recommendation), - 2.5 kg/ha (reduce 2-3 irrigation depending on location and 5.0 kg/ha(reduce 2-3 irrigation depending on location)in the sub plots and three levels of Nutrient management practices (Organic nutrient management(locally available resources), Inorganic nutrient management and Integrated nutrient management in sub sub plots. Pod yield (2104 kg/ha), haulm yield(4025 kg/ha), nodules/plant (40.3), shelling per cent (68.9%), hundred kernel weight (40.2g), B:C ratio (2.11) and r net monetary returns (Rs.43172/ha) were obtained with biodegradable mulch which was significantly higher than practice without mulching (1650 kg/ha , 3276 kg/ha,34, 63.2 %, 32.7 g, 1.66 and Rs. 25499/ ha), respectively. Application of hydrogel @5.0 kg/ha to groundnut also significantly influenced pod yield of groundnut (2326 kg/ha) than control and other lower levels. The integrated nutrient management practices followed in groundnut was found to be significant with respect to pod yield(2397 kg/ha) and yield attributing characters than either fully organic or inorganic nutrient management practices.The combined application with biodegradable mulch, hydrogel @5.0 kg/ha and integrated nutrient management practices followed in groundnut proved to be significantly superior with respect to pod yield of groundnut (2397 kg/ha),net return of Rs. 54524 Rs./ha and benefit cost ratio of 2.40 over other combinations studied.

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Key Words :
Mulching, hydrogel, Nutrient management, Groundnut

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Groundnut (*Arachis hypogaea* L.) is one of the important oilseed crops of India and annually it is cultivated on an area of 5.5 M ha with production of 9.5 M tonnes and productivity of 1723 kg/ha (2013-14). In the recent years, the area under summer groundnut has increased due to assured and higher profit as well as productivity. Among the various factors that limit the productivity of groundnut, low temperature prevailing during germination, water and nutrient management are very important. Use of polythene mulches been reported to cut down water requirement of irrigated summer groundnut and increases the temperature by 4-5^0 C that favors seedling emergence. Further, water requirement can be reduced with the application of "Pusa hydrogel" which is an indigenous semi synthetic super absorbent technology for conserving water and enhancing crop productivity and thereby increases the water

use efficiency (IARI, 2012). Hydrogel absorbs and retains large quantities of plant available water (Alessandro Sannino, 2008). Fertilizer leaching can thus be reduced (Buchholz and Graham, 1998; Kazanskii and Dubrovskii, 1992). During the soil drying process, both water and water soluble nutrients are released to the plant in a uniform manner. The higher water availability helps to avoid water stress during longer periods of water scarcity. During the water release phase of the hydrogel, free pore volume will be created within the soil, offering additional space for root growth and air and water infiltration and storage. Consequently, water is stored in the root zone so that water and plant nutrient losses due to deep percolation and nutrient leaching can be avoided. In this way water and nutrients are available to the plant over a longer period of time (Buchholz and Graham, 1998). According to Taylor and Halfacre (1986), this allows stronger and healthier plant growth also under hot and dry climate conditions and therefore increases the safety margin and yield potential in plant production. Further, integration of inorganic fertilizers with organics manures and biofertilizers will not only sustain the crop production but also will be effective in improving soil health and enhancing the nutrient-use efficiency (Verma *et al*., 2005). Information on combined use of polythene mulch, hydrogel and nutrient management practices in groundnut is lacking, hence, the present investigation was undertaken.

EXPERIMENTAL METHODOLOGY

Field experiment was carried out during *Rabi*-Summer, 2013-14 at the AICRP on Groundnut, Bhubaneswar Centre, OUAT. The soil of this plot was Sandy loam in texture, poor in nutrient content and low in water holding capacity, slightly acidic in reaction (plt-5.9), low in organic carbon (0.32), available in nitrogen (262 kg ha^{-1}) in available phosphorus (14 kg ha^{-1}), in available potassium (143 kg ha^{-1}). The experiment was conducted in a split-plot design with three replications, two mulching practices (With biodegradable mulch and Without biodegradable mulch) in the main plot sown with three hydrogel levels (Control (Irrigation as per recommendation), - 2.5 kg/ha (reduce 2-3 irrigation depending on location and 5.0 kg/ha(reduce 2-3 irrigation depending on location)in the sub plots and three levels of Nutrient management practices (Organic nutrient management (locally available resources), Inorganic

Table 1 : Dry pod yield, dry haulm yield and number of pods plant^{-1} of groundnut as influenced by mulching, hydrogel and nutrient management during *Rabi*-summer, 2013-14

Mulching levels	Hydrogel levels	Nutrient management practices											
		Dry pod yield(kg/ha)				Dry haulm yield(kg/ha)				Root nodules per plant at 80 DAS			
		N_1	N_2	N_3	Mean	N_1	N_2	N_3	Mean	N_1	N_2	N_3	Mean
M_1	H_1	1803	1937	1827	1856	3595	3720	3645	3653	37.3	38.6	37.3	37.7
	H_2	2020	2231	2137	2129	3830	4225	4020	4025	43.3	41.3	40.3	41.6
	H_3	2080	2501	2397	2326	3930	4830	4430	4397	47.7	45.7	31.3	41.6
	Mean	1968	2223	2120	2104	3785	4258	4032	4025	42.8	41.9	36.3	40.3
M_2	H_1	1471	1602	1520	1531	3025	3110	3058	3064	31.7	32.0	32.0	31.9
	H_2	1630	1730	1700	1687	3210	3410	3375	3332	33.7	35.3	35.0	34.7
	H_3	1680	1780	1740	1733	3325	3500	3470	3432	34.3	36.3	36.0	35.5
	Mean	1594	1704	1653	1650	3187	3340	3301	3276	33.2	34.5	34.3	34.0
Comparing the means of		S.E. ±		LSD (0.05)		S.E. ±		LSD (0.05)		S.E. ±		LSD (0.05)	
Main plot (M)		0.91		2.9		3.69		12.0		0.16		0.51	
Sub-plot (H)		1.12		3.6		4.5		14.7		0.19		0.63	
Sub-sub-plot (N)		52.6		153.0		87.9		255.7		0.97		2.82	
M x H		1.58		5.2		6.4		20.8		0.27		0.88	
N at s same level of M		74.4		124.4		124.4		361.6		1.37		3.99	
N at s same level of H		91.2		152.3		152.4		442.9		1.68		4.89	
N at s same level of M x H		128.9		374.8		215.5		626.4		2.38		6.91	
M at same or diff. level of N		43.0		125.0		72.1		209.8		0.84		2.47	
M x H at same or diff. level of N		74.5		216.5		124.9		363.4		1.45		4.24	
Co-efficient of variation (%)		11.9				10.2				11.1			

Table 2 : Shelling per cent, hundred Kernel weight (g) and B:C ratio of groundnut as influenced by mulching, hydrogel and nutrient management during *Rabi*-summer, 2013-14

Mulching levels	Hydrogel levels	Nutrient management practices											
		Shelling per cent				HKW(g)				B:C ratio			
		N_1	N_2	N_3	Mean	N_1	N_2	N_3	Mean	N_1	N_2	N_3	Mean
M_1	H_1	67.0	67.7	66.3	67.0	36.0	37.0	36.3	36.4	1.81	1.94	1.83	1.86
	H_2	68.3	61.7	70.0	66.7	38.3	42.3	40.0	40.2	2.05	2.23	2.14	2.14
	H_3	69.3	75.3	74.3	73.0	39.3	46.7	44.3	43.4	2.09	2.51	2.40	2.33
	Mean	68.2	68.2	70.2	68.9	37.9	42.0	40.2	40.0	1.98	2.23	2.12	2.11
M_2	H_1	60.3	61.7	61.3	61.1	30.3	31.0	30.7	30.7	1.47	1.60	1.53	1.53
	H_2	62.0	64.7	64.3	63.7	32.0	34.0	33.7	33.2	1.64	1.74	1.71	1.70
	H_3	64.0	65.3	65.0	64.8	33.3	35.0	34.7	34.3	1.68	1.79	1.74	1.74
	Mean	62.1	63.9	63.5	63.2	31.9	33.3	33.0	32.7	1.60	1.71	1.66	1.66
Comparing the means of		S.E. ±		LSD (0.05)		S.E. ±		LSD (0.05)		S.E. ±		LSD (0.05)	
Main plot (M)		0.82		2.69		0.13		0.42		0.003		0.01	
Sub-plot (H)		1.009		3.29		0.16		0.51		0.004		0.01	
Sub-sub plot (N)		1.33		3.87		0.83		2.42		0.053		0.16	
M x H		1.42		4.65		0.22		0.72		0.005		0.02	
N at s same level of M		1.88		5.47		1.18		3.42		0.075		0.22	
N at s same level of H		2.30		6.70		1.44		4.19		0.092		0.27	
N at s same level of M x H		3.26		9.47		2.04		5.93		0.131		0.38	
M at same or diff. level of N		1.79		5.61		0.72		2.1		0.044		0.13	
M x H at same or diff. level of N		3.11		9.73		0.24		3.64		0.076		0.81	
Co-efficient of variation (%)		8.5				9.7				12.0			

Table 3 : Gross return (Rs./ha), cost of cultivation (Rs./ha) and net return (Rs./ha) of groundnut as influenced by mulching, hydrogel and nutrient management during *Rabi*-summer, 2013-14

Mulching levels	Hydrogel levels	Nutrient management practices											
		Gross return (Rs./ha)				Cost of cultivation (Rs./ha)				Net return (Rs./ha)			
		N_1	N_2	N_3	Mean	N_1	N_2	N_3	Mean	N_1	N_2	N_3	Mean
M_1	H_1	70304	75556	71253	72371	38913	38949	38936	38933	31390	36606	32317	33438
	H_2	78780	87009	83356	83048	38504	39017	38951	38824	40275	47991	44404	44223
	H_3	81120	97526	93470	90705	38752	38854	38946	38851	42367	58671	54524	51854
	Mean	76735	86697	82693	82042	38723	38940	38944	38869	38011	47756	43748	43172
M_2	H_1	57369	62400	59280	59683	38938	39000	38748	38895	18430	23400	20532	20787
	H_2	63570	67480	66300	65783	38683	38776	38773	38744	24886	28694	27527	27036
	H_3	65520	69420	67860	67600	39000	38855	38925	38927	26520	30565	28934	28673
	Mean	62153	66433	64480	64355	38874	38877	38815	38855	23279	27553	25664	25499
Comparing the means of		S.E. ±		LSD (0.05)		S.E. ±		LSD (0.05)		S.E. ±		LSD (0.05)	
Main plot (M)		37.1		120.9		60.4		197.2		53		173	
Sub-plot (H)		45.4		148.1		74		241		65		217	
Sub-sub-plot (N)		2054		5970.8		71		207		2064		5999	
M x H		64.2		209.5		104		341		92		300	
N at s same level of M		2905		8444.1		100.5		292.1		2919		8485	
N at s same level of H		3558		10342		123		358		3575		10391	
N at s same level of M x H		5032		14675		174		506		5056		14695	
M at same or diff. level of N		1678		4879		120		381		1688		4907	
M x H at same or diff. level of N		2907		8452		207		659		2923		8499	
Co-efficient of variation (%)		11.9				1.7				16.3			

nutrient management and Integrated nutrient management in sub sub plots.

Recommended fertilizer for upland rice was 20 kg N, 40 kg P_2O_5 and 40 kg K_2O ha^{-1}which were applied in the form of urea (46% N), single super phosphate (16% P_2O_5) and murate of potash (60% K_2O), respectively. The cultivar sown was Devi. Ten plants selected randomly from the net plot were used for post harvest studies.

EXPERIMENTAL FINDINGS AND DISCUSSION

Result indicated that the response of summer groundnut to mulching, hydrogel application and nutrient management practices was found significant with respect to pod yield and yield attributing characters. Practice with biodegradable mulch produced significantly higher pod yield (2104 kg/ha), haulm yield (4025 kg/ha), nodules/ plant (40.3), shelling per cent(68.9%), hundred kernel weight (40.2g), B:C ratio ((2.11) and higher net monetary returns (Rs. 43172/ha) as compared to without mulching (1650 kg/ha, 3276 kg/ha, 34, 63.2 per cent, 32.7 g, 1.66 and Rs. 25499/ha), respectively (Table 1, 2 and 3).

Application of hydrogel @5.0 kg/ha to groundnut also significantly influenced pod yield of groundnut (2326 kg/ha) than control and other lower levels. The integrated nutrient management practices followed in groundnut was found to be significant with respect to pod yield (2397 kg/ha) and yield attributing characters than either fully organic or inorganic nutrient management practices (Table 1).

The combined application with biodegradable mulch, hydrogel @5.0 kg/ha and integrated nutrient management practices followed in groundnut proved to be significantly superior with respect to pod yield of groundnut (2397 kg/ha), net return of Rs. 54524Rs./ha and benefit cost ratio of 2.40 over other combinations studied.

Conclusion :

On the basis of the experimental data, it can be concluded that use of biodegradable mulch, hydrogel @ 5 kg/ha and integrated nutrient management practices significantly improved the productivity and gave higher monetary returns in summer groundnut.

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