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RESEARCH ARTICLE

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Response of wheat (*Triticum aestivum* L.) to integrated nitrogen management and their residual effect on succeeding forage cowpea (*Vigna unguiculata* L.)

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ABSTRACT : Field experiment was conducted at B. A. College of Agriculture, Anand (Gujarat) during *Rabi* season of 2012-13 and 2013-14 to evaluate Response of wheat (*Triticum aestivum* L.) to integrated nitrogen management and their residual effect on succeeding forage cowpea (*Vigna unguiculata* L.). Seven nitrogen management treatments through chemical fertilizer and manures and three levels of bio-fertilizer inoculation were replicated three times. Result of the experiment revealed that75% RDN + 25% RDN from FYM when applied in the wheat it produced higher growth, yield attributing characters, grain yield (3716 kg ha^{-1}) and net returns (Rs. 29304 ha^{-1}) while, application of 100% RDN (120 kg N) produced higher straw yield (7771 kg ha^{-1}) of wheat. The seed inoculation with *Azotobacter chroococum* and *Azospirillum lipoferum* maximize the growth, yield attributing characters, yields of wheat (3328 kg ha^{-1}) and secured higher net return (Rs. 21932 ha^{-1}). However, green fodder (275 q ha^{-1}), dry matter yield of succeeding forage cowpea (66 q ha^{-1}) were significantly influenced by residual effect of treatment 25% RDN + 25% from FYM + 25% from VC + 25% from CC. *Azotobacter* + *Azospirilium* inoculation treatment were maximize green fodder 250 and dry fodder yield 60 q $ha^{-1}$of wheat-forage cowpea sequence in sandy loam soils under middle Gujarat agro-climatic conditions.

KEY WORDS : Wheat, Forage cowpea, INM, Biofertilizer inoculation, Residual effect

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INTRODUCTION

Wheat (*Triticum aestivum* L.) is a cereal grain that people can eat. It is kind of grass whose fruit is a “head of wheat” with edible seeds. It was first grown in the levant, a region of the Near East. Now it is cultivated all over the world (*https://simple.m.wikipedia.org*). It provides about 20 per cent of total food calories for the

human race (Hossain *et al.,* 2006).

In India, Gujarat ranks sixth in wheat production and the area under wheat crop is about 12.740lakh hectares, average yield 3,155kg ha^{-1} with total production of 40.195 lakh tones (Anonymous, 2013).

Nitrogen (N) is often the most deficient of all plant nutrients. Wheat is very sensitive to sufficient nitrogen and very responsive to nitrogen fertilization (Anonymous, 2001). An adequate and optimum supply of nitrogen is required for vegetative growth and for maintaining genetical potential while, the deficit and excess reduce the production potential of crop (Singh *et al.*, 2006). The supplementary and complementary use of organic manures *viz.,* FYM, vermicompost, castor cake and inorganic fertilizers plays an important role in the growth and development of crop (Virmani, 1994). Non- symbiotic bacteria like *Azotobacter* and *Azospirillum* are potential bio-fertilizers capable of contributing nitrogen to a number of non-legume crops by trapping aerial reservoir (Ram and Mir, 2006). The integrated approach of nutrient supply by using organic, inorganic and bio-fertilizers is gaining importance, because this system not only reduces the use of costly inorganic fertilizers, but also it is an eco-friendly approach (Sawarkar *et al.,* 2013). The application of organic manures may serve as excellent source of macro and micro nutrients (Kathuria *et al*., 2005).

The package of practices so far generated on fodder cowpea is for getting maximum green and dry fodder production during lean period of the summer season, as animal husbandry has become a roaring business. Therefore, the study was undertaken in the present investigation as yield, quality parameters of wheat (*Triticum aestivum* L.) and nutrient status of soil as influenced by integrated nitrogen management and their residual effect on succeeding forage cowpea (*Vigna unguiculata* L.).

EXPERIMENTAL METHODS

A field experiment was carried out at the College Agronomy Farm, B.A. College of Agriculture, Anand Agricultural University, Anand, Gujarat during *Rabi* and summer seasons of the years 2012-13 and 2013-14 on Plot No. A-33 with succeeding forage cowpea (EC-4216) taken after main crop of wheat (GW-366) on the same plot.

The soil of experimental site was sandy loam with 7.5 pH, organic carbon 0.38 per cent, EC 26 dsm^{-1}, available N 199.5 kg ha^{-1}, P_2O_5 32.17 kg ha^{-1} and high K_20 of 389.00 kg ha^{-1}. The experiment was laid out in Factorial Randomized Block Design having three replications.

Twenty one treatment combinations comprised of seven nitrogen management through chemical fertilizer and manures (F) *viz.,* F_1:100 % RDN (from chemical fertilizer), F_2: 75 % RDN + 25 % RDN from FYM,F_3: 75 % RDN + 25 % RDN from Vermicomost,F_4: 75 % RDN + 25 % RDN from Castor cake, F_5: 50 % RDN + 25 % RDN from FYM + 25 % RDN from Vermicomost, F_6: 50 % RDN + 25 % RDN from FYM + 25 % RDN from castor cake and F_7: 25 % RDN + 25 % RDN from FYM + 25 % RDN from Vermicompost + 25 % RDN from castor cake and three levels of bio-fertilizer inoculation (B)B_1:No bio-fertilizer inoculation, B_2: *Azotobacter chroococcum (ABA-1)* inoculation, B_3: *Azotobacter chroococcum* (*ABA-1*) + *Azospirillum lipoferum* (*ASA-1*) inoculation. The required quantity of FYM, vermi-compost and castor cake were calculated equivalent to 25, 50 and 75 per cent of recommended nitrogen as the per treatments and they were applied uniformly to the respective treatment plots. The common application of phosphorus along with 50 per cent of the nitrogen as per the treatments through single super phosphate and urea, respectively were applied uniformly in the opened furrows as basal. Remaining 50 per cent nitrogen as per the treatments was given as top dressing in the form of urea on the next day of fourth irrigation. No fertilizer was given to succeeding forage cowpea. Succeeding forage cowpea was taken in layout plots of wheat without disturbing the plat demarcations. Wheat crop was harvested during the month of March 2012-13 and 2013-14 years.

EXPERIMENTAL RESULTS AND ANALYSIS

The results obtained from the present investigation as well as relevant discussion have been summarized under the following heads :

Effect of nitrogen management:

Treatment F_1 recorded significantly higher plant height (38.25 cm) at 30 DAS and (65.45 cm) at 60 DAS in pooled result, as compared to treatment F_7, but treatments F_2, F_4, F_3, F_6 were found at par with treatment

F_1. This increase in plant height it is might be due greater transfer of photosynthates from source to sink (Pathak *et al*., 2002).

The treatment F_2 recorded significantly taller plant at 90 DAS (91.91 cm) than treatments F_5 and F_7, but was found at par with treatments F_1, F_4, F_3 and F_6. It might be due to synchronous supply of nutrient throughout during the growth period from combined application of inorganic sources with FYM (Halder *et al.*, 2008).

Significantly higher number of effective tillers plant^{-1} (6.09), length of ear (10.58 cm) and number of grains earhead^{-1} (44.45) were registered during pooled result under the treatments F_2. It might be due to that organic and inorganic sources maintained the availability of nitrogen at optimum level at critical growth stage of the crop, thus, it increases effectiveness of the tillers. (Barik *et al.*,2006). Similar treatment recorded significantly higher grain yield per plant (13.97 g) and test weight (39.48 g). The per cent increase in grain yield per plant in treatment F_2 was 25.06 per cent over the treatment F_7, it's probably due to better growth and development of crop, which increase uptake of nutrient and better nourishment of grains resulting in bold size of grain (Kathuria *et al*., 2005).

Significantly higher grain yield (3,716 kg ha^{-1}) was found under the treatment F_2 as compared other treatments but, it was at par with treatments F_1 and F_2 on pooled analysis basis. The per cent increase in grain yield in the treatments F_2, F_1 and F_3 were 43.91, 38.57 and 38.18, respectively over the treatment F_7.

An increase in grain yield under treatment F_2 was might be due that application of 75 per cent N through chemical and 25 per cent from FYM, as organics might have exerted favourable effect on the soil chemical, physical and bio logical properties resulting of better utilization of nutrients which in turn resulted in greater values of growth and yield parameters (Biswas and Reddy, 2010).

In pooled analysis, the treatment F_1 recorded significantly higher straw yield (7,771 kg ha^{-1}) was at par with treatment F_2. Higher straw yield under treatments F_1 and F_2 over the treatment F_7 was probably due to higher level of nitrogen gave more vegetative growth resulting better utilization of nutrients, water, solar radiation and increased metabolic activity, which might have produced maximum dry matter production (Arun Kumar *et al.*,

Table 1: Effect of INM and Bio-fertilizer levels on growth, yield attributing character, yields, harvest index, netreturn and BCR of wheat (Pooled value of 2 years)

Treatments	Plant height (cm)			No. of eff. tillers plant^{-1}	Length of ear (cm)	No. of grains earhead^{-1}	Grain yield plant^{-1}	Test Wt. (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	HI (%)	Net return (Rs. ha^{-1})	BCR
	30 DAS	60 DAS	90 DAS										
Nitrogen management (F)													
F_1:	38.25	65.45	89.54	5.90	10.40	43.37	13.05	37.47	3578	7771	46.44	26799	1.99
F_2:	36.78	63.98	91.91	6.09	10.58	44.45	13.97	39.48	3716	7610	48.99	29304	1.98
F_3:	35.89	60.93	87.68	5.51	10.32	42.60	12.11	36.98	3568	7133	50.38	26173	1.87
F_4:	36.00	61.36	88.98	5.13	10.04	43.02	11.66	35.92	3378	6742	50.23	20840	1.68
F_5:	34.61	59.19	85.85	4.92	9.78	42.65	11.35	33.84	2723	6534	41.94	13909	1.42
F_6:	34.77	59.66	86.90	4.76	9.73	42.00	11.27	31.42	2582	6567	39.45	10700	1.32
F_7:	33.84	56.08	84.09	3.93	9.63	39.63	11.17	30.75	2624	5514	49.66	10220	1.28
S.E. ±	0.72	1.36	1.21	0.17	0.16	0.69	0.23	0.84	71	226	2.72	-	-
C.D. (P=0.05)	2.03	3.82	3.40	0.49	0.45	1.94	0.63	2.36	200	783	NS	-	-
Bio-fertilizer inoculation (B)													
B_1:	33.62	57.96	86.11	4.92	9.69	41.42	11.39	33.62	3031	6551	47.22	17792	1.59
B_2:	34.62	60.89	86.71	5.01	10.20	42.05	12.07	34.62	3142	6953	45.47	19394	1.64
B_3:	37.13	64.01	90.73	5.60	10.32	44.12	12.79	37.13	3328	7013	47.50	21932	1.72
S.E. ±	0.55	0.89	0.79	0.11	0.10	0.45	0.15	0.55	47	86	0.98	-	-
C.D. (P=0.05)	1.54	2.50	2.22	0.32	0.29	1.27	0.42	1.54	131	243	NS	-	-
F x B	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-	-

NS= Non-significant

2009).

Nitrogen management treatments failed to reflect their significant effect on harvest index in pooled analysis. The lowest harvest index (39.45%) was registered in treatment F_6. The results are in agreement with the findings of Singh *et al.* (2006).

Effect of bio-fertilizer inoculation:

Treatment B_3 recorded significantly the highest plant height at 30 DAS and 60 and 90 DAS were recorded under treatment B_3 in pooled analysis. This might be partly owing to their additive effect of nitrogen fixed from the atmosphere and partly owing to synthesis of biologically active substances which in turn might have stimulated plant growth parameters (Kachroo and Ravinder, 2006).

The results revealed that significantly the highest effective tillers plant^{-1} (5.06), higher length of ear (10.32 cm) and significantly the highest number of grains earhead^{-1} (44.12) was found at par with treatment B_2. Enhancement growth parameters was due to synthesis of biologically active substances (Sushila and Giri, 2000).

Treatment B_3 recorded significantly the highest grain yield plant^{-1} (13.05 g), test weight (37.0 g). This improvement in grain yield plant^{-1} might nutrients which helped in maintaining better source to sink relationship by increasing sink capacity by its key role in energy transformation. Increased nutrient supply influenced the vegetative growth, which performed indirect function for formation of hormones cytokinines, which promotes maximum flowering in the crop resulting in higher yield attributing characters (Kachroo and Ravinder, 2006).

Significantly the highest grain yield (3,228 kg ha^{-1}) and higher straw yield (7,013 kg ha^{-1}) was noticed under seed inoculation with treatment B_3 *(Azotobacter chroococcum +Azospirillum lipoferum)* in pooled analysis. Application of bio-fertilizers to wheat crop it increase the values of growth and yield parameters and thereby resulted in the significantly higher grain and straw yield.

Harvest index of wheat was not influenced significantly due to bio-fertilizer inoculation. However, maximum (47.50%) and minimum (45.47%) values of harvest index were noted under treatments B_3 and B_2, respectively in pooled analysis.

Residual effect on succeeding forage cowpea:

Significantly higher green fodder yield and dry fodder yield of forage cowpea was recorded under the treatment F_7 (25% RDN + 25% from FYM + 25% from VC + 25% from CC). However, non-significant result was found

Table 2: Residual effect of INM and Bio-fertilizer levels on green fodder and dry fodder yield of succeeding forage cowpea

(Pooled value of 2 years)

Treatments	Green fodder yield (q ha^{-1})	Dry fodder yield (q ha^{-1})
Nitrogen management (F)		
F_1:	204	49
F_2:	249	60
F_3:	235	57
F_4:	211	51
F_5:	259	62
F_6:	249	60
F_7:	275	66
S.E. ±	12.81	3.09
C.D. (P=0.05)	NS	NS
Bio-fertilizer inoculation (B)		
B_1:	233	56
B_2:	238	57
B_3:	250	60
S.E. ±	4.35	1.05
C.D. (P=0.05)	12.24	2.95
F x B	NS	NS

NS= Non-significant

in pooled analysis. This might be owing to the availability of nitrogen during entire growing season because of slow mineralization of organic nitrogen from applied organic manures to wheat crop (Nag and Roy, 2008).

Residual effect of bio-fertilizer inoculation showed significant variation in green and dry matter yield of succeeding fodder cowpea. Bio-fertilizer inoculation treatment B_3 registered significantly higher green fodder yield of succeeding forage cowpea (250 q ha^{-1}) in pooled analysis followed by treatment.

REFERENCES

Anonymous (2013). Farmers' Portal" Ministry of Agriculture.

Arun Kumar, G. K., Chandrika, V. and Reddy, P.M.(2009). Influence of integrated nitrogen management on yield, nitrogen uptake, soil fertility status and economics of baby corn. *Indian J. Agric. Res.*, **43** (3): 227-229.

Barik, A.K., Das, A., Giri, A. K. and Chatopaddhyay, G. N. (2006). Effect of organic (vermi-compost, farmyard manure) and chemical sources of plant nutrient on productivity and fertility of *Kharif* rice *(Oryza sativa* L.*). Crop Res.*, **31** (3) : 339-342.

Biswas, A. and Reddy, P. R. (2010). Effect of integrated nutrient management on soil available nutrients, plant nutrient uptake and yield of aerobic paddy (*Oryza sativa* L.). *J. Interacademicia.*,**14** (4): 463-469.

Hossain, Md. I., Islam, Md. K., Sufian, Md. A., Meisner, C. A. and Islam, Md. S. (2006). Effect of planting method and nitrogen levels on yield and yield attribute of wheat. *J. Bio-Sci.*,**14**: 127-130.

Kachroo, D. and Ravinder, R. (2006).Growth, nutrient uptake and yield of wheat (*Triticum aestivum*) as influence by bio-fertilizers and nitrogen. *Indian J. Agron.*,**51** (1): 37-39.

Kathuria, M.K., Singh, H., Singh, K.P. and Kadian, V. S. (2005). Effect of INM on wheat grain and some physio-chemical properties of soil under cereal fodder-wheat cropping system. *Crop Res.*, **30**(1): 10-14.

Nag, K. and Roy, A.K.S. (2008). Residual effect of vermi-compost, chemical fertilizer and bio-fertilizer in wheat (*Triticum aestivum*) on succeeding fodder cowpea (*Vigna unguiculata*). *Ann. Agric. Res. New Series.*,**29** (1- 4): 73-77.

Pathak, S.K., Singh, S.B. and Singh S.N. (2002). Effect of integrated management on growth, yield and economics in maize (*Zea mays*)-wheat (*Triticuma estivum*) cropping system. *Indian J. Agron.*,**47** (3): 325-332.

Ram, T. and Mir, M.S. (2006). Effect of integrated nutrient management on yield and yield-attributing characters of wheat (*Triticum aestivum*). *Indian J. Agron.*, 51 (3):189-192.

Sawarkar, S. D. and Goydani, B.M. (1996). Effect of fertilizer and *Azospirillum* on grain yield of rainfed wheat (*Triticum aestivum*). *Indian J. Agron.*, **41** (3): 409-411.

Sawarkar, S.D., Kamparia, N.K., Thakur, Dewda, M. and Singh, M. (2013). Effect pf long term application of inorganic fertilizer and organ ic manure on yield, potassium uptake and profile distribution fraction in vertisol under soybean-wheat cropping system. *J. Indian Soc. Soil Sci.*, **61** (2): 94-98.

Singh, V., Singh, R. K. and Parihar, C. M. (2006). Effect of nutrient management using aqua-fertilization on yield, quality and nutrient uptake of wheat under dryland conditions.*Ann. Agric. Res. New Series*, **27** (4): 297-301.

Sushila, R. and Giri, G. (2000). Influence of farmyard manure, nitrogen and bio-fertilizers on growth, yield attributes and yield of wheat (*Triticum aestivum)* under limited water supply. *Indian J. Agron.*,**45**(3): 590-595.

Virmani, S. M. (1994). UNCTAD Agenda-21: The new challenges for soil. *J. Indian Soc. Sci.*, **42**: 516-524.

■ WEBLIOGRAPHY

Anonymous. *https://simple.m.wikipedia.org.*

Anonymous (2001).*www.agrculure.alberta.ca.*

Halder, K., Singh, S. and Pawar, D. (2008) *http//www. agric ulture journal. Org/*p: 757.