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Effect of Different Varieties and Levels of Nitrogen on Post-Harvest Parameters of Wheat (*Triticum aestivum* L.)

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ABSTRACT

*The present study entitled, "*Effect of Different Varieties and Levels of Nitrogen on Post-Harvest Parameters of Wheat (*Triticum aestivum* L.)*" was conducted during the winter season of 2009-10 on sandy clay loam soils of Students' farm, College of Agriculture, Acharya N. G. Ranga Agricultural University, Rajendranagar, Hyderabad. The treatments consisted of three varieties (HP 4080, RAJ 4037 and HI 8682) and four nitrogen levels (0, 60, 120 and 180 kg N ha^{-1}). The experiment was laid out in randomized block design with varieties as first factor and nitrogen levels as second factor with three replications. The findings of experiment are summarized below. Apparent recovery fraction, protein content was maximum with the variety RAJ 4037. Physiological efficiency was more with variety HP 4080. Agronomic efficiency was found to be on par with all the three varieties and all the nitrogen levels. Protein content was maximum with 180 kg N ha^{-1}. Apparent recovery fraction was maximum with 60 kg N ha^{-1} physiological efficiency with 120 kg N ha^{-1}. The nitrogen uptake in grain and straw was maximum with variety RAJ 4037. Among the nitrogen levels, 180 kg N ha^{-1} recorded significantly maximum uptake of nitrogen in grain and straw.*

Key words: *Post harvest parameters, Triticum aestivum.*

INTRODUCTION

Wheat is the most important and widely cultivated food crop in the world. In India, Wheat is the second important cereal crop, first being Rice. In India wheat occupies an area of 28.15 million hectares with a total production of 758.06 million tonnes with an average productivity of 2,708 kg ha^{-1}.

In Andhra Pradesh, wheat occupies an area of 10,000 hectares with a total production of 9,000 tonnes with an average productivity of 900 kg ha^{-1} which is very less when compared to the national average productivity. To improve the production of wheat, as in any other crop, introduction of varieties with a high yield potential is essential.

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Variety contributes more than 50 percent of the increased production. The next important component for increased production is the nutrient availability. Native fertility level of the tropical soils with special reference to nitrogen is invariably insufficient for touching the peak production mark of a variety and hence, the need for supplementing this nutrient is obvious with most varieties.

Productivity of wheat is governed by improved varieties coupled with matching production technology. Suitability of varieties to a particular agro- climate is the most important factor in realizing their yield potential which is further influenced by their response to application of nutrients, particularly nitrogen. Selection of suitable genotype is of prime importance as the genetic potential of varieties limits response to nitrogen. Moreover, varieties differ both in yield and nutrient uptake. Hence, it is necessary to find out the correct dose of nitrogen and suitable varieties for maximizing wheat yields in Southern Telangana agro-climatic zone. Therefore, the present study was carried out.

MATERIALS AND METHODS

The experiment was conducted during *rabi* on sandy loam soils at students' farm, College of Agriculture, Rajendranagar, Hyderabad which is geographically situated at $17^0.19^1$ N latitude, 78^028^1 E longitudes and at an altitude of 542.3 m above mean sea level, covered under Southern Telangana agro-climatic zone of Andhra Pradesh. The weekly mean average temperature of 29.7°c minimum temperature 15.7°c. mean relative humidity ranged from 45 to 82 per cent. The total rain fall received during the crop growth period was 44.8 mm spread in three rainy days. The weekly mean sunshine hours varied from 4.4 to 9.1 with an average of 7.66 hours per day and mean evaporation ranged from 4.8 to 7.9 mm with an average of 6.2 mm per day. The mean wind speed ranged from 1.6 to 5.4 km hr $^{-1}$ with an average of 3.2 km hr. $^{-1}$ during the crop growth period

1. **Protein content in grains (%):** grain protein was calculated by microkjeldhal method.
2. **Total (grain and straw) N uptake by crop (kg ha^{-1}) at harvest:** Total (grain and straw) nitrogen contents were estimated by kelplus method.
3. **Agronomic efficiency:** Agronomic efficiency was calculated by using the formula

$$\frac{\text{Yield in fertilized plot (kg ha}^{-1}\text{) - Yield in control plot (kg ha}^{-1}\text{)}}{\text{Quantity of fertilizer nutrient applied (kg ha}^{-1}\text{)}}$$

4. **Physiological efficiency:** Physiological efficiency was calculated by using the formula

$$\frac{\text{Total dry matter yield of fertilized crop (kg) -Total dry matter yield of unfertilized crop (kg)}}{\text{Nutrient uptake by fertilized crop (kg) - Nutrient uptake by unfertilized crop in (kg)}}$$

5. **Apparent Recovery Fraction (ARF):** Apparent recovery fraction was calculated by the formula

$$\frac{\text{Nutrient uptake by fertilized crop – nutrient uptake by unfertilized crop}}{\text{Quantity of fertilized crop}} \times 100$$

RESULTS

Grain yield:

The grain yield of wheat was significantly influenced by varieties and nitrogen levels. The variety RAJ 4037 recorded the highest grain yield (2930kg ha^{-1}) which was significantly superior to the other two varieties tested. The results were in conformity with Parihar and Tiwari[6], Behara and Pradhan[3] and Sharma and Ashok Kumar[8].

Increasing the nitrogen level from 0 kg ha^{-1} to 180 kg ha^{-1} significantly increased the grain yield from 1506.66 kg ha^{-1} to 3821.11 kg ha^{-1}. The increase in grain yield with enhanced N levels can be ascribed to better plant growth and dry matter production due to higher photosynthetic area. The results were in corroboration with findings of Sharma and Manohar[9] that increase in yield was upto 120 kg N ha^{-1}

The interaction effect studies of grain yield have shown that highest grain yield (4033.00 kg ha^{-1}) was obtained at 180 kg N ha^{-1} with the variety RAJ 4037 which was significantly higher than HI 8682 and HP 4080

Straw yield:

The data on straw yield are in accordance with grain yield. Among the varieties RAJ 4037 recorded the significantly higher straw yield (3249.58 kg ha^{-1}) over HI 8682 (3107.50 kg ha^{-1}) and HP 4080 (3078.75 kg ha^{-1}). Similar differences in straw yields were noticed in the experiments conducted by Sharma and Ashok Kumar[8] and Bastia and Rout[2].

Increasing the nitrogen level from 0 kg ha^{-1} to 180 kg ha^{-1} has significantly increased the straw yield from 1882.77 kg ha^{-1} to 4123.88 kg ha^{-1}. Similar results were also reported by Anil Kumar *et al*[1]. (2001) and Sushila and Gajendra Giri[10].

The interaction studies have shown that RAJ 4037 recorded significantly higher straw yield (4253.33 kg ha^{-1}) followed by HI 8682 at 180kg ha^{-1} which is in turn significantly higher than HP 4080 at 180kg ha^{-1}

Dry matter accumulation:

Dry matter accumulation was found to be influenced by different varieties and varying nitrogen levels and interaction was found significant at harvest. At 30, 60 and 90 DAS variety RAJ 4037 has recorded significantly higher dry matter over the other two varieties tested. This can be attributed to variability in number of tillers and leaf area which has led to higher accumulation of photosynthates in RAJ 4037. The variation among cultivars has also been reported by Satish Kumar *et al*[7]., and Mosalem *et al*[5].

With increase in applied nitrogen the crop responded well irrespective of varieties leading to more dry matter accumulation due to higher photosynthesis, contributed by higher leaf area resulting in the accumulation of significantly higher dry matter. These results were in conformity with the findings of Satish Kumar *et al*[7]., and Mosalem *et al*[5].The interaction between the varieties and nitrogen levels was found to be significant at harvest. At harvest variety RAJ 4037 at 180 kg N ha^{-1} produced the maximum dry matter (8286.66 kg ha^{-1}).

Protein content:

Protein content of wheat was significantly influenced by wheat varieties. RAJ 4037 recorded significantly higher protein (10.94 %) content over HI 8682 which was on par with HP4080.

Increasing the nitrogen levels from 0 kg ha^{-1} to 180 kg ha^{-1} significantly increased the protein content. Nitrogen is the essential component of amino acids, thus increased level of nitrogen increased the uptake which resulted in higher protein content. These results were in conformity with the findings of Anil Kumar *et al*[1].

The interactions effect of varieties and nitrogen levels on protein content has shown that the protein content (12.83) was significantly high in RAJ 4037 at 180 kg N ha^{-1} compared to all other interaction effects

Nitrogen uptake (grain and straw):

The total nitrogen uptake was significantly influenced by wheat varieties and nitrogen levels. Nitrogen uptake was significantly high (71.15 kg ha^{-1}) in RAJ 4037 compared to the other two varieties i.e., HP 4080 (64.92 kg ha^{-1}) and HI 8682 (67.39 kg ha^{-1}).

Increase in the nitrogen levels from 0 kg ha^{-1} to 180 kg ha^{-1} increased the nitrogen uptake significantly and application of 180kg ha^{-1} recorded significantly high (95.18 kg ha^{-1}) N uptake. The increase in dry matter accumulation together with higher nitrogen levels lead to the higher uptake of nitrogen by plants. Incremental dose of nitrogen might have resulted in its increased absorption from the soil. Similar findings were reported by Jaiswal[4] and Singh[11] where uptake increased significantly up to 120 kg N ha^{-1}

The interaction effect of varieties and nitrogen levels has revealed that at 180 kg N ha^{-1} nitrogen uptake was significantly higher (100.73 kg ha^{-1}) by the variety RAJ 4037 compared to all other interaction effects

Agronomic efficiency:

Agronomic efficiency of wheat was not significantly influenced by varieties. Increasing the nitrogen level from 60 kg ha^{-1} to 180 kg ha^{-1} significantly decreased the agronomic efficiency. This might be due to the crop failed to record more yield over control at higher doses of nitrogen. Similar decrease in agronomic efficiency of wheat at higher doses of nitrogen was observed by Singh *et al*[11].

The interactions effect of varieties and nitrogen levels on agronomic efficiency was found to be non-significant

Physiological efficiency:

Physiological efficiency of wheat was significantly influenced by varieties and nitrogen levels. The variety HP 4080 (63.96) registered significantly superior physiological efficiency over the other two varieties tested.

Among the nitrogen levels significantly high physiological efficiency was obtained at 120 kg N ha^{-1} followed by 60 kg N ha^{-1}which was on par with 180 kg N ha^{-1} (Table 4.22). At 180 kg N ha^{-1} the uptake of nitrogen over control was higher and subsequent increases in dry matter accumulation over control was lower when compared to lower levels of nitrogen. Similar decrease similar results were observed by Singh *et al*[11].

Study on interaction effect revealed that among all the treatment combinations the variety HP 4080 recorded maximum physiological efficiency at 120 kg N ha^{-1}.

Apparent recovery fraction

Apparent recovery fraction of wheat was significantly influenced by varieties and nitrogen levels. Among the varieties RAJ 4037 and HI 8682 recorded significantly higher apparent recovery fraction (27.44) over HP 4080.

Increase in nitrogen levels from 0 kg ha^{-1} to 180 kg ha^{-1} significantly decreased the apparent recovery fraction. This might be due to the crop failed to uptake more nitrogen over control at higher doses of nitrogen. Similar decrease in apparent recovery fraction of wheat at higher doses of nitrogen was observed by Singh *et al*[11].

Studies on interactions effect has shown that the variety RAJ 4037 at 60 kg N ha^{-1} has recorded significantly higher apparent recovery fraction of 46.10 compared to all other interaction effects.

Table 1: Dry matter accumulation (kg ha^{-1}) of wheat as influenced by varieties and nitrogen levels

Treatment	10 DAS	30 DAS	60 DAS	90 DAS	harvest
Varieties					
HP 4080	127.00	1235.83	2575.00	4457.50	5739.16
RAJ 4037	132.83	1309.58	2797.08	4735.00	6179.58
HI 8682	131.00	1259.58	2705.00	4536.25	5891.66
S.Em ±	0.74	8.85	18.27	15.76	26.72
C.D (P=0.05)	2.17	20.47	53.61	43.23	78.41
Nitrogen levels					
0 kg N ha^{-1}	104.88	735.55	1855.55	2638.88	3386.44
60 kg N ha^{-1}	125.55	1078.33	2433.33	4258.88	5390.55
120 kg N ha^{-1}	134.88	1440.00	3011.11	5210.55	7022.22
180 kg N ha^{-1}	155.77	1819.44	3469.44	6196.66	7945.00
S.Em ±	0.85	10.22	21.10	18.20	30.86
C.D (P=0.05)	2.51	29.98	61.88	53.39	90.55
Interaction (V X N)	N.S	N.S	N.S	N.S	156.82

Table 2: Interaction effect of different varieties and nitrogen levels on dry matter accumulation (kg ha^{-1}) at harvest

Treatments	**Varieties**			
	HP 4080	RAJ 4037	HI 8682	**Mean**
Nitrogen levels kg ha^{-1}				
0 kg N ha^{-1}	3146.66	3631.66	3390.00	3389.44
60 kg N ha^{-1}	5395.00	5533.33	5243.33	5390.55
120 kg N ha^{-1}	6773.33	7266.66	7026.66	7022.22
180 kg N ha^{-1}	7641.66	8286.66	7906.66	7945.00
Mean	5739.16	6179.58	5891.66	
S.Em ±	**53.45**			
C.D (P=0.05)	**156.82**			

Table 3: Grain yield (kg ha^{-1}), Straw yield (kg ha^{-1}) and Harvest Index (%) of wheat as influenced by varieties and nitrogen levels

Treatment	**Grain yield (kg ha^{-1})**	**Straw yield (kg ha^{-1})**	**Harvest index (HI)**
Varieties			
HP 4080	2660.41	3078.75	45.74
RAJ 4037	2930.00	3249.58	47.02
HI 8682	2784.16	3107.50	46.90
S.Em ±	10.86	17.61	0.19
C.D (P=0.05)	31.85	51.65	0.57
Nitrogen level			
0 kg N ha^{-1}	1506.66	1882.77	44.17
60 kg N ha^{-1}	2513.00	2876.66	46.44
120 kg N ha^{-1}	3324.44	3697.77	47.34
180 kg N ha^{-1}	3821.11	4123.88	48.08
S.Em ±	12.55	20.34	0.22
C.D (P=0.05)	36.81	59.64	0.66
Interaction (V X N)	63.77	103.36	1.14

Table 4: Interaction effect of different varieties and nitrogen levels on Grain yield (kg ha^{-1})

Treatments	**Varieties**			
	HP 4080	**RAJ 4037**	**HI 8682**	**Mean**
Nitrogen levels kg ha^{-1}				
0 kg N ha^{-1}	1400.00	1613.33	1506.66	1506.66
60 kg N ha^{-1}	2388.33	2646.66	2506.66	2513.88
120 kg N ha^{-1}	3213.33	3426.66	3333.33	3324.44
180 kg N ha^{-1}	3640.00	4033.33	3790.00	3821.11
Mean	2660.41	2930.00	2784.16	
S.Em ±	**21.73**			
C.D (P=0.05)	**63.77**			

Table 5: Interaction effect of different varieties and nitrogen levels on Straw yield (kg ha^{-1}

Treatments	**Varieties**			
	HP 4080	**RAJ 4037**	**HI 8682**	**Mean**
Nitrogen levels kg ha^{-1}				
0 kg N ha^{-1}	1746.66	2018.33	1883.33	1882.77
60 kg N ha^{-1}	3006.66	2886.66	2736.66	2876.66
120 kg N ha^{-1}	3560.00	3840.00	3693.33	3697.77
180 kg N ha^{-1}	4001.66	4253.33	4116.66	4123.88
Mean	3078.75	3249.58	3107.50	
S.Em ±	**35.23**			
C.D (P=0.05)	**103.36**			

Table 6: Interaction effect of different varieties and nitrogen levels on harvest index

Treatments	**Varieties**			
	HP 4080	**RAJ 4037**	**HI 8682**	**Mean**
Nitrogen levels kg ha^{-1}				
0 kg N ha^{-1}	43.64	44.42	44.44	44.17
60 kg N ha^{-1}	44.28	47.83	47.80	46.64
120 kg N ha^{-1}	47.44	47.15	47.44	47.34
180 kg N ha^{-1}	47.63	48.67	47.93	48.08
Mean	45.74	47.02	46.90	---
S.Em ±	**0.39**			
C.D (P=0.05)	**1.14**			

Table 7: Apparent Recovery Fraction, Physiological efficiency, Protein content and Agronomic efficiency of wheat as influenced by varieties and nitrogen levels

Treatment	Apparent recovery fraction	Physiological efficiency	Protein content (%)	Agronomic efficiency
Varieties				
HP 4080	26.23	63.96	9.86	11.00
RAJ 4037	27.44	53.75	10.94	11.44
HI 8682	26.78	57.01	10.25	11.14
S.Em ±	0.47	0.73	0.03	0.12
C.D (P=0.05)	0.98	2.15	0.09	N.S
Nitrogen level				
0 kg N ha^{-1}	0.00	0.00	8.46	0.0
60 kg N ha^{-1}	42.04	76.85	9.69	16.78
120 kg N ha^{-1}	34.07	80.07	11.03	15.14
180 kg N ha^{-1}	31.16	75.69	12.23	12.85
S.Em ±	0.54	0.84	0.04	0.14
C.D (P=0.05)	1.14	2.48	0.12	0.42
Interaction (V X N)	0.99	4.31	0.19	N.S

Table 8: Interaction effect of different varieties and nitrogen levels on ARF

Treatments	**Varieties**			
	HP 4080	**RAJ 4037**	**HI 8682**	**Mean**
Nitrogen levels kg ha^{-1}				
0 kg N ha^{-1}	0.00	0.00	0.00	0.00
60 kg N ha^{-1}	41.64	46.10	42.88	43.54
120 kg N ha^{-1}	35.77	40.54	37.42	37.91
180 kg N ha^{-1}	30.82	36.07	33.44	33.44
Mean	27.06	30.68	28.43	
S.Em ±	**0.34**			
C.D (P=0.05)	**0.99**			

Table 9: Interaction effect of different varieties and nitrogen levels on physiological efficiency

Treatments	Varieties			
	HP 4080	**RAJ 4037**	**HI 8682**	**Mean**
Nitrogen levels kg ha^{-1}				
0 kg N ha^{-1}	0.00	0.00	0.00	0.00
60 kg N ha^{-1}	89.90	68.67	71.97	76.85
120 kg N ha^{-1}	84.49	74.68	81.04	80.07
180 kg N ha^{-1}	80.37	71.67	75.03	75..69
Mean	63.69	53.75	57.01	
S.Em ±	**1.46**			
C.D (P=0.05)	**4.31**			

Table 10: Interaction effect of different varieties and nitrogen levels on protein content

Treatments	Varieties			
	HP 4080	**RAJ 4037**	**HI 8682**	**Mean**
Nitrogen levels kg ha^{-1}				
0 kg N ha^{-1}	8.24	8.74	8.40	8.46
60 kg N ha^{-1}	9.34	10.11	9.61	9.69
120 kg N ha^{-1}	10.17	12.10	10.84	11.03
180 kg N ha^{-1}	11.70	12.83	12.16	12.23
Mean	9.86	10.94	10.25	---
S.Em ±	**0.06**			
C.D (P=0.05)	**0.19**			

Table: 11: Total (grain and straw) nitrogen uptake by crop (kg ha^{-1}) at harvest of wheat as influenced by varieties and nitrogen levels

Treatment	N uptake
Varieties	
HP 4080	64.92
RAJ 4037	71.15
HI 8682	67.39
S.Em ±	0.14
C.D (P=0.05)	0.42
Nitrogen levels	
0 kg N ha^{-1}	34.82
60 kg N ha^{-1}	60.96
120 kg N ha^{-1}	80.32
180 kg N ha^{-1}	95.18
S.Em ±	0.16
C.D (P=0.05)	0.48
Interaction (V X N)	0.84

Table 12: Interaction effect of different varieties and nitrogen levels on total grain and straw nitrogen uptake (kg ha^{-1}) at harvest

Treatments	Varieties			
	HP 4080	**RAJ 4037**	**HI 8682**	**Mean**
Nitrogen levels kg ha^{-1}				
0 kg N ha^{-1}	33.96	35.83	34.68	34.82
60 kg N ha^{-1}	58.96	63.51	60.41	60.96
120 kg N ha^{-1}	76.89	84.49	79.58	80.32
180 kg N ha^{-1}	89.89	100.73	94.89	95.18
Mean	64.92	71.15	67.39	
S.Em ±	**0.28**			
C.D (P=0.05)	**0.84**			

CONCLUSION

Among the three varieties, RAJ 4037 was found the best in terms of Nitrogen uptake, Protein content in grain and apparent recovery fraction.

Nitrogen uptake and Protein content in grain are maximum with 180 kg N ha^{-1}.

Physiological efficiency was highest in HP 4080 and at 120 kg N ha^{-1}.

Agronomic efficiency was maximum with 60 kg N ha^{-1}.

RAJ 4037 is found to be the best variety in terms of yield and among nitrogen doses 180 kg N ha^{-1} found best.

REFERENCES

1. Anil Kumar, Bikram Singh, and Jagdev Singh, Response of macaroni wheat (*Triticum durum*) to nitrogen, phosphorus and sodic water on loamy-sand soils of south-west Haryana. *Indian Journal of Agronomy*, **46(1):** 118-121 (2001).
2. Bastia, D.K. and Rout, A.K., Response of Wheat (*Triticum aestivum*) cultivars to fertilizers and limited irrigation. *Indian journal of Agronomy*, **46(4):** 670-673 (2001).
3. Behera, U.K. and Pradhan, S., Performance of very late sown bread wheat cultivation as influenced by different level of nitrogen in the vertisols of central India. *Annals if Agriculture Research*, **20(2):** 127-131 (2007).
4. Jaiswal, V.P. and Singh, G.R., Effect of planting methods, source and level of nitrogen on growth and yield of rice (*Oryza sativa*) and on succeeding wheat (*Triticum aestivum*). *Indian Journal of Agronomy*, **46(1):** 5-11 (2001).
5. Mosalem, M.E., Zahran, M., El Menoufi, M.M and Moussa, A.M., Effect of nitrogen fertilization levels on some wheat cultivars. Soil Fertility and Plant Nutrition (2000).
6. Parihar, S.S. and Tiwari, R.B., Effect of irrigation and nitrogen levels on yield, nutrient uptake and water use of late-sown wheat (*Triticum aestivum*). *Indian Journal of Agronomy*, **48(2):** 103-107 (2003).
7. Satish Kumar, Bangwara, A.S. Singh, D.P. and Phogat, S.B., Dry matter accumulation in dwarf wheat varieties under different nitrogen levels and sowing dates. *Haryana agricultural University Journal of Research*, **28:** 151-157 (1998).
8. Sharma, K.D. and Ashok Kumar, Physiological processes associated with grain yield of wheat under restricted soil moisture. Indian Journal of Plant Physiology, **14(1):** 55-59 (2009).
9. Sharma, P.K. and Manohar, S.S., Response of wheat (*Triticum aestivum* L.) to nitrogen and sulphur and their residual effect on pearl millet (*Pennisetum glaucum* L.). *Indian Journal of Agronomy*, **47(4):** 473-476 (2002).
10. Sushila, R. and Gajendra Giri, Influence of farm yard manure, nitrogen and biofertilizers on growth, yields attributes and yield of Wheat (*Triticum aestivum*) under limited water supply. *Indian journal of Agronomy*. **45(3):** 590-595 (2000).
11. Singh, R.K., Agarwal, R.L. and Sandip K. Singh, integrated nutrient management in wheat (*Triticum aestivum*). *Annals of agricultural Research New series*. **28(1):** 200-24 (2007).