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RESEARCH PAPER

Yields and economics of wheat (*Triticum aestivum* L.) influenced by SWI techniques with varying nitrogen levels

P.K. SURYAWANSHI*, J.B. PATEL[1] AND N.M. KUMBHAR
Department of Agronomy, B. A. College of Agriculture, (A A.U.),
ANAND (GUJARAT) INDIA

Abstract : A field experiment was conducted during the *Rabi* season of the year 2009-10 to study the yields and economics of wheat (*Triticum aestivum* L.) influenced by SWI techniques with varying nitrogen levels . Effect of four spacings (S_1: 10 x 20 cm, S_2: 15 x 20 cm, S_3: 20 x 20 cm and S_4: 22.5 cm line sowing were) studied on three levels of nitrogen (N_1: 100 kg N ha^{-1}, N_2: 125 kg N ha^{-1} and N_3: 150 kg N ha^{-1}). The higher grain yield (4,205 kg ha^{-1}), straw yield (6,111 kg ha^{-1}), the highest gross realization (Rs. 53,509 ha^{-1}), net realization (Rs. 35,373 ha^{-1}) with CBR (2.95) were obtained from 20 x 20 cm cross sowing technique. Different levels of nitrogen significantly influenced yields, gross realization, net realization with CBR. Higher grain yield (4,126 kg ha^{-1}), straw yield (6,135 kg ha^{-1}) and gross realization (Rs. 52,577. ha^{-1}), net realization (Rs. 33,791 ha^{-1}) with CBR (2.80) were obtained from 150 kg N ha^{-1} . Treatment combination S_3N_3 gave maximum straw yield, gross return, net return with CBR.

Key Words : Nitrogen levels, Wheat, SWI

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INTRODUCTION

Wheat *(Triticum aestivum)* is an important cereal crop for a large number of countries in the world. It provides about 20 per cent of total food calories for the human diet. It can be grown on a variety of soils but clay loam soil is most suitable (Hossain Md. *et al.*, 2006). In India, wheat stands second next to rice in area and production, but first in productivity among all the cereals.

Method of sowing play very important role providing for the proper space required by plant for efficient utilization of air, water, solar energy and nutrients, therefore, the crop yield and quality of the produce may be improved to great extent (Makwana and Tank, 2008).

System of wheat intensification (SWI) popularly known *Sri Vidhi Gehun* is different methodology for wheat cultivation. Its root goes in SRI principle being practiced in paddy. All agronomic principles are put into practices and integrated with package of practices in wheat crop.Nitrogen is the key element for plant growth and development, as it is a constituent of chlorophyll.

MATERIALS AND METHODS

A field experiment was carried out at the Regional Research Station, Anand Agricultural University. Anand, Gujarat during the *Rabi* season of the year 2009-10. Physical and chemical properties of the soil of experimental site are given in (Table A).

The experiment was laid out in Factorial Randomized Block Design having four replications. Twelve treatment combinations comprised of four spacings *viz.*, S_1: 10 x 20 cm, S_2: 15 x 20 cm, S_3: 20 x 20 cm and S_4: 22.5 cm line sowing and three levels of nitrogen *viz.*, N_1 100, N_2 125, N_3 150 kg N ha^{-1} were studied.

Certified seed of wheat variety 'GW - 496' was soaked in

*** Author for correspondence**
[1]Regional Research Station, B. A. College of Agriculture (A.A.U.), ANAND (GUJARAT) INDIA

Table A : Physical and chemical properties of the soil of the experimental site

Properties	Values
Mechanical composition	
Coarse sand (%)	1.04
Fine sand (%)	82.90
silt (%)	9.81
Clay (%)	5.36
Textural class of soil	Loamy sand
Chemical composition	
EC (dsm^{-1})	0.23
Soil pH	7.5
Organic carbon (%)	0.39
Total N	0.032
Available N ($kg\ ha^{-1}$)	110.20
Available P_2O_5($kg\ ha^{-1}$)	42.70
Available K_2O ($kg\ ha^{-1}$)	346

Table B : Seed treatment for SWI method in spacing treatments S_1, S_2 and S_3.

Item	Quantity
Hot water (boiled at 60 degree celsius)	50 $lit.ha^{-1}$
Vermicompost	12.5 $kg\ ha^{-1}$
Wheat seeds	S_1: 50 $kg\ ha^{-1}$
	S_2: 33 $kg\ ha^{-1}$
	S_3: 25 $kg\ ha^{-1}$
Cow urine	15 $lit.ha^{-1}$
Jaggery	5 $kg\ ha^{-1}$
Bavistine (Fungicide)	@ 5 g kg^{-1} of seeds

boiled water to separate lighter seeds and ensure use of good quality heavy and healthy seeds. It was mixed with vermicompost, cow urine and jaggery for 6-8 hours. After 6-8 hours, it was filtered so that solid material along with seeds and liquid got separated. These seeds were then treated with the fungicide bavistin @ 5 g kg^{-1} seeds and the treated seeds were wrapped in bundle of jute for 6-8 hours for sprouting of the seeds. These sprouted seeds were used for sowing purpose in treatment S_1, S_2, S_3 only during the month of November, and the crop was harvested during the second week of March. The seed treatment was adopted as per the procedure given in the literature of SWI technique of wheat (Anonymous, 2008).Gap filling was done with the appropriate seeds at 12 days after sowing to maintain uniformity of plant population. Requirement for the seed treatment given in (Table B).

The nitrogen fertilizer was applied as per treatment through urea and phosphorus @ 60 $kg\ ha^{-1}$ was applied in the form of SSP as basal dose to all treatments. The remaining half dose of nitrogen was top dressed in two equal splits each at CRI and grain filling stages. The experimental field was free from weeds throughout the crop season. Therefore, two hand weedings were carried out at 20, 40 days after sowing. Seven irrigations were given throughout crop life period. Remaining all agronomic practices were followed as per recommendations for the crop.

RESULTS AND DISCUSSION

The results obtained from the present investigation have been presented under following heads: (Table 1).

Effect of spacings :

The crop sown under spacing S_3 (20 x 20 cm) showed significantly higher grain (4,204 $kg\ ha^{-1}$), straw yield (6,111 $kg\ ha^{-1}$) due to better utilization of moisture and nutrients as well as solar radiation due to better orientation of the leaves resulting greater amount of photosynthesis leading to increased values of growth and yield parameters then thereby grain and straw yield. Plant spacing of 20 x 20 cm gave the highest gross realization Rs. 53,509 ha^{-1} and net realization of Rs. 35,373 ha^{-1} with CBR value of 2.95.

The next best treatment was S_2 (15 x 20 cm) which recorded the gross realization Rs. 51,719 ha^{-1} and net return of

Rs. 33,734 ha^{-1} with the CBR value of 2.87. Treatments S_1 (10 x 20 cm) and line sowing at 22.5 cm (S_4) recorded the least net income of Rs. 30,593 and 26,961 ha^{-1} with 2.67 and 2.39 Cost benefit ratio, respectively. These results are in close agreement with those reported by Jain *et al.* (1987).

Effect of nitrogen levels :

The various levels of nitrogen significantly influenced

Table 1 : Effect of spacings and nitrogen levels on yields and economics of wheat

Treatments	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Gross realization (kg ha^{-1})	Total cost of Production (Rs. ha^{-1})	Net realization (Rs. ha^{-1})	CBR
Spacing (S)						
S_1 (10 x 20)	3843	5493	48863	18270	30593	2.67
S_2 (15 x 20)	4065	5883	51719	17985	33734	2.87
S_3 (20 x 20)	4205	6111	53509	18135	35373	2.95
S_3 (22.5)	3639	5385	46358	19397	26961	2.39
C.D. (P=0.05%)	220	250	-	-	-	-
Nitrogen level (N) kg ha^{-1}						
N_1 (100)	3718	5460	47346	18116	29230	2.62
N_2 (125)	3970	5559	50414	18438	31976	2.74
N_3 (150)	4126	6135	52577	18786	33791	2.80
C.D. (P=0.05%)	191	217	-	-	-	-
S X N Interaction	NS	Sig.	-	-	-	-
C.V. (%)	6.73	7.27	-	-	-	-

(Sig.: Significant) (NS: Non-significant)

Table 2 : Straw yield as influenced by S x N interaction

Spacing (S)	Inorganic fertilizer		
	N_1 (100)	N_2 (125)	N_3 (150)
S_1 (10 x 20)	5245	5601	5633
S_2 (15 x 20)	5485	5729	6433
S_3 (20 x 20)	5861	5708	6765
S_4 (22.5)	5250	5198	5708
S.E.±		196	
C.D. (P=0.05)		434	

Table 3: Economics as influenced by different treatment combinations of spacings and nitrogen levels

Treatments	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Gross realization (Rs. ha^{-1})	Total cost of production (Rs. ha^{-1})	Net realization (Rs. ha^{-1})	CBR
S_1N_1	3715	5245	47202	17939	29263	2.63
S_2N_1	3823	5485	48617	17655	30963	2.75
S_3N_1	3921	5861	49981	17805	32176	2.81
S_4N_1	3413	5250	43582	19066	24516	2.29
S_1N_2	3968	5601	49215	18261	30954	2.70
S_2N_2	4163	5729	52824	17977	34848	2.94
S_3N_2	4239	5708	53726	18127	35600	2.96
S_4N_2	3607	5198	45889	19388	26501	2.37
S_1N_3	3946	5633	50171	18609	31563	2.70
S_2N_3	4208	6433	53714	18324	35390	2.93
S_3N_3	4453	6765	56820	18475	38345	3.08
S_4N_3	3896	5708	49601	19736	29866	2.51

Note : Selling price of grain @ Rs.12 kg^{-1}, Selling price of straw @ Rs. 0.50 kg^{-1}

the yields and economical component Table 1. Significantly higher grain yield (4,126 kg ha^{-1}) and straw yield (6,135 kg ha^{-1}) were recorded under N_3 150 kg N ha^{-1} over N_1, which was found at par with N_2.

The higher grain and straw yields under higher level of nitrogen might be due to application of higher nitrogen dose, enhanced higher photosynthetic activity of the plant and might have increased vegetative growth, such as spike length and ultimately resulted into higher number of grains earhead-^{1} which increases grain and straw yields. Hossain Md. *et al*. (2006) also recorded same results.

The highest gross return (Rs. 52,577 ha^{-1}) and net return was recorded under treatment N_3 (Rs. 33,791 ha^{-1}) with the cost benefit ratio of 2.80 followed by treatment N_2 wich recorded the gross return (Rs. 50,414 ha^{-1}) and net return of Rs. 31,976 ha^{-1} with 2.74 CBR. Treatment N_1 registered lower gross return (Rs. 47,346 ha^{-1}) and net return (Rs. 29,230 ha^{-1}) with 2.62 CBR. These results obtained inthe present investigation are in accordance with those reported by Sharma and Mishra (1986).

Interaction effect :

Straw yield of wheat was found to be significant due to interaction effect between spacings and nitrogen levels (S x N). Interaction data are given in Table 2 indicated that treatment combination S_3N_3 (20 x 20 cm spacing with 150 kg N ha^{-1}) recorded significantly higher straw yield (6,765 kg ha^{-1}) as compared to the rest of the treatment combinations, however, it was found to be at par with the treatment combinationsS_2N_3 (15 x 20 cm spacing with 150 kg N ha^{-1}). The lowest straw yield (5,198 kg ha^{-1}) was recorded under the treatment combination S_4N_2 (22.5 cm line sowing with 125 kg N ha^{-1}). With respect to various treatment combinations of spacings and nitrogen levels, treatment combination S_3N_3 (20 x 20 cm with 150 kg N ha^{-1}) recorded the highest net return by Rs. 38,345 and CBR value (3.08) (Table 3). These results were due to the facts of higher yield in the said treatment combination as compared to others. The lowest net realization (Rs. 24,516 ha^{-1}) with CBR value of 2.29 was observed under treatment S_4N_1.

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