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"Effect of fertility levels and seed rates on growth, yield and quality of wheat (*Triticum aestivum* L.)"

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ABSTRACT

The study titled "Effect of Fertility Levels and Seed Rate on Growth, Yield, and Quality of Wheat (*Triticum aestivum* L.)" was conducted during the rabi (winter) season of 2020-21 at the student instructional field, Department of Agronomy, Faculty of Agriculture, AKS University, Satna (M.P.), on sandy loam soil. The experiment comprised four fertility levels (0 kg/ha, 50 kg/ha, 75 kg/ha, & 100kg/ha) and three seed rates (S_1=80kg/h, S_2=90kg/h, and S_3=100kg), laid out in a Randomized Block Design with factorial concept and three replications.The findings indicated that nitrogen at 100 kg/ha resulted in superior growth parameters, yield attributing characters, yield, and grain quality compared to other nitrogen levels. Among the seed rates, 90kg/h demonstrated higher growth parameters, yield attributes, yield, and quality characteristics significantly.The treatment combination with nitrogen at 100 kg/ha and seed rate at 90kg/h exhibited significantly higher grain yield, straw yield per hectare, gross and net monetary returns, and benefit-cost ratio (B: C ratio) of wheat. These values, recorded at 5.47 t/ha, 6.83 t/ha, ₹ 104242.65 Rs/ha, ₹ 80392.68 Rs/ha, and 4.51 respectively, were notably superior to other treatments. Regardless of nitrogen fertility levels, seed rate had a pronounced effect on vegetative growth and yield attributing characters in wheat.

Keywords: Fertility Levels, Seed Rate, Wheat, Growth Yield and Quality Wheat.

INTRODUCTION

Wheat (Triticum aestivum L.) stands as India's second staple food crop, belonging to the Poaceae family and serving as a staple globally, particularly crucial to India's food security alongside rice. In the rabi season of 2012-13, India produced 95.91 million tonnes of wheat, contributing to 12% of the world's food production, cultivated across 31.34 million hectares with a productivity of 30.61 quintals per hectare (Anonymous, 2020). The primary wheat-growing

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states include Uttar Pradesh, Madhya Pradesh, Punjab, and Haryana. Uttar Pradesh leads in both area and production, while Punjab tops in productivity, with Madhya Pradesh also playing a significant role in wheat cultivation. In 2014-15, Madhya Pradesh cultivated over 5000 thousand hectares of wheat, yielding more than 13000 thousand tonnes, with an average yield of about 26.00 quintals per hectare (Anonymous, 2020).

Nitrogen stands as a crucial factor for plant growth and development, though it's prone to various losses like denitrification, volatilization, and leaching, posing environmental risks. Normalized Difference Vegetation Index (NDVI) aids in improving nitrogen use efficiency, which globally stands at approximately 33% for cereal production, including wheat (Raun and Johnson, 1999). However, wheat's nitrogen use efficiency (NUE) remains typically low due to losses from volatilization, denitrification, and inefficient splitting of nitrogen doses, coupled with excessive nitrogen applications. Hence, utilizing NDVI techniques becomes vital to optimize nitrogen fertilizer use efficiency and boost yields.

To enhance nitrogen use efficiency, top dressing and split application of nitrogenous fertilizers during critical growth stages of wheat are advocated (Singh, 1988). The availability of nitrogen during various growth phases significantly influences wheat yield and grain quality (Zende et al., 2005). Split application of nitrogen helps improve nitrogen use by the crop while reducing nutrient loss through leaching, denitrification, runoff, and volatilization. Proper timing of nitrogen fertilization is a major agronomic practice affecting wheat crop growth and yield. Determining the right nitrogen fertilizer rates and timing of application plays a decisive role in achieving higher yields (Pali and Sharma, 1992).

Among various factors affecting crop production, planting pattern holds great significance as it determines proper crop stand establishment. Optimal seed rate is crucial for maximizing crop yield. Using excessive seed rates results in increased plant population and competition among plants for water, nutrients, and sunlight, leading to lower quality and yield. Conversely, using fewer seeds leads to reduced yield due to a lower number of plants per unit area (Singh and Uttam, 1994). Optimal seed rates can enhance productivity by promoting a greater number of tillers per unit area and reducing weed growth through smothering action.

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Seeding rates significantly impact wheat tillering and ultimately grain yield, facilitating more efficient utilization of available natural resources (Naveen et al., 2017).

MATERIALS ANDMETHODS

The current experiment took place during the rabi season of 2020-21 at the Student Instructional Field, Department of Agronomy, Faculty of Agriculture, AKS University, Sherganj, Satna (M.P.). The mean temperature ranged from 10.20º C (minimum) to 45.0º C (maximum), while humidity varied from 87.00% (morning) to 75.00% (evening). The soil in the experimental field was identified as silty clay loam, with moderate levels of organic carbon (0.43%), available nitrogen (176.6 kg/ha), available phosphorus (12.5 kg/ha), and moderate levels of available potassium (200.50 kg/ha). The pH of the soil was 7.5, and the electrical conductivity (EC) was 0.16 ds/m. The experiment comprised twelve treatment combinations (F_0S_1, F_0S_2, F_0S_3, F_1S_1, F_1S_2, F_1S_3, F_2S_1, F_2S_2, F_2S_3, F_3S_1, F_3S_2, F_3S_3), involving four fertility levels (F_0= 0 kg/ha, F_1= 50 kg/ha, F_2=75 kg/ha, and F_3=100 kg/ha) and three seed rates (S_1=80kg/ha, S_2=90kg/ha, and S_3= 100kg), arranged in a Factorial Randomized Block Design with three replications. Each plot had a gross and net size of 5 m x 3 m, respectively, and received fertilizers according to the recommended dose.Lok-1 is a wheat variety suitable for timely sown, late sown, and irrigated conditions, yielding an average of 36-40 quintals per hectare. It typically matures early (126-134 days) and reaches a height of 90-100 cm at maturity. Lok-1 wheat variety was sown according to the treatments, with seed rates of 80, 90, and 100 kg/ha, respectively. To ensure uniform plant height, seeds were weighed separately for each plot and manually sown in furrows spaced 22.5 cm x 15 cm apart. Sowing took place on 15-11-2021, following pre-sowing irrigation to ensure optimal soil moisture content. The crop received a total of six irrigations, with seeds sown manually at a depth of approximately 5 cm, followed by irrigation.

RESULTSANDDISCUSSION

Plant height (cm) at 90 DAS

The interaction effect between different levels of fertility and seed rate was found to be significant variation in plant height at 90 DAS. It is apparent from the data that plant height increased with the advancement in the fertility levels and seed rates. Among different fertility levels F_3 (100 kg N/ha) (92.38 cm) sown crop exhibited significantly greater plant height at 90 DAS of plant growth while the minimum plant height was recorded under the F_0 (00 kg N/ha) (79.64 cm), respectively. Among different seed rates, plant height was also differed significantly. Plant height was recorded significantly greater in S_2 (90kg/h) (87.74 cm) at 90 DAS of plant growth. However the minimum plant height was recorded S_1 (80kg/h) (84.32 cm). Interaction between fertility levels x seed rates was found significant at 90 DAS of plant growth in which F_3S_2 (93.91 cm) and the minimum plant height was recorded F_0S_1 (76.18 cm).

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Number of tillers /plant

The interaction effect between fertility and seed rate was found to be significant for variation in number of tillers per meter row length. It is apparent from the data that Number of tillers per plant increased with the advancement in the fertility levels and seed rates. Among different fertility levels F_3 (100 kg N/ha) (90.22) sown crop exhibited significantly greater Number of tillers per plant at 60 DAS of plant growth while the minimum Number of tillers per plant was recorded under the F_0 (80kg/h) (70.67), respectively. Among different seed rates, Number of tillers per plant was also differed significantly. Number of tillers per plant was recorded significantly greater in S_2 (90kg/h) (83.00) at 60 DAS of plant growth. However the minimum Number of tillers per plant was recorded S_1 (80kg/h) (78.33). Interaction between fertility levels x seed rates was found significant at 60 DAS of plant growth in which F_3S_2 (92.00) and the minimum Number of tillers per plant was recorded F_0S_1 (68.33).

Length of spike (cm)

The interaction effect between fertility and seed rate was found to be significant for variation in length of spike. It is apparent from the data that Length of spike increased with the advancement in the fertility levels and seed rates. Among different fertility levels F_3 (100 kg N/ha) (13.24 cm) sown crop exhibited significantly greater Length of spike at maturity of plant while the minimum Length of spike was recorded under the F_0 (80kg/h) (11.19 cm), respectively. Among different seed rates, Length of spike was also differed significantly. Length of spike was recorded significantly greater in S_2 (90kg/h) (12.49 cm) at maturity of plant. However the minimum Length of spike was recorded S_1 (80kg/h) (11.94 cm). Interaction between fertility levels x seed rates was found significant at maturity of plant in which F_3S_2 (13.53 cm) and the minimum Length of spike was recorded F_0S_1 (10.78 cm).

Number of grain per spike

The interaction effect between fertility and seed rate was found to be significant for variation in number of grain per spike. It is apparent from the data that Number of grain per spike increased with the advancement in the fertility levels and seed rates. Among different fertility levels F_3 (100 kg N/ha) (49.56) sown crop exhibited significantly greater Number of grain per spike at maturity of plant while the minimum Number of grain per spike was recorded under the F_0 (80kg/h) (43.66), respectively. Among different seed rates, Number of grain per spike was also differed significantly. Number of grain per spike was recorded significantly greater in S_2 (90kg/h) (47.44) at maturity of plant. However the minimum Number of grain per spike was recorded S_1 (80kg/h) (46.03). Interaction between fertility levels x seed rates was found significant at maturity of plant in which F_3S_2 (50.09) and the minimum Number of grain per spike was recorded F_0S_1 (43.16).

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Grain yield (t/ha)

The interaction effect between fertility and seed rate was found to be significant for variation inGrain yield (t/ha). It is apparent from the data that Grain yield increased with the advancement in the fertility levels and seed rates. Among different fertility levels F_3 (100 kg N/ha) (5.47 t/ha) sown crop exhibited significantly greater Grain yield at maturity of plant while the minimum Grain yield was recorded under the F_0 (80kg/h) (3.64 t/ha), respectively. Among different seed rates, Grain yield was also differed significantly. Grain yield was recorded significantly greater in S_2 (90kg/h) (4.78 t/ha) at maturity of plant. However the minimum Grain yield was recorded S_1 (80kg/h) (4.35 t/ha). Interaction between fertility levels x seed rates was found significant at maturity of plant in which F_3S_2 (5.70 t/ha) and the minimum Grain yield was recorded F_0S_1 (3.45 t/ha)

Straw yield (t/ha)

The interaction effect between fertility and seed rate was found to be significant for variation in Straw yield (t/ha). It is apparent from the data that Straw yield increased with the advancement in the fertility levels and seed rates. Among different fertility levels F_3 (100 kg N/ha) (6.83 t/ha) sown crop exhibited significantly greater Straw yield at maturity of plant while the minimum Straw yield was recorded under the F_0 (80kg/h) (5.20 t/ha), respectively.Among different seed rates, Straw yield was also differed significantly. Straw yield was recorded significantly greater in S_2 (90kg/h) (6.18 t/ha) at maturity of plant. However the minimum Straw yield was recorded S_1 (80kg/h) (5.85 t/ha). Interaction between fertility levels x seed rates was found significant at maturity of plant in which F_3S_2 (6.93 t/ha) and the minimum Straw yield was recorded F_0S_1 (5.13 t/ha).

Harvest Index %

The interaction effect between fertility and seed rate was found to be significant for variation in Harvest Index %. It is apparent from the data that Harvest Index increased with the advancement in the fertility levels and seed rates. Among different fertility levels F_3 (100 kg N/ha) (44.47 %) sown crop exhibited significantly greater Harvest Index at maturity of plant while the minimum Harvest Index was recorded under the F_0 (80kg/h) (41.17 %), respectively. Among different seed rates, Harvest Index was also differed significantly. Harvest Index was recorded significantly greater in S_2 (90kg/h) (43.45 %) at maturity of plant. However the minimum Harvest Index was recorded S_1 (80kg/h) (42.43 %). Interaction between fertility levels x seed rates was found significant at maturity of plant in which F_3S_2 (45.15 %) and the minimum Harvest Index was recorded F_0S_1 (40.19 %).

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Table 1 Effect of Fertility levels, Seed Rate and their Interaction on plant height (cm) at 90 DAS of Wheat

Seed Rate	Fertility levels				
	F_0 0Kg N/ha	F_1 50Kg N/ha	F_2 75Kg N/ha	F_3 100Kg N/ha	Mean
S_1	76.18	83.44	86.67	91.01	84.32
S_2	82.27	85.70	89.09	93.91	87.74
S_3	80.45	85.18	87.95	92.22	86.45
Mean	79.64	84.77	87.90	92.38	

	S.Em.±	**C.D. (p= 0.05)**
F	0.23	0.68
S	0.20	0.59
F x S	0.40	1.17

Table 2 Effect of Fertility levels, Seed Rate and their Interaction on Number of Tillers per plant at Maturity of Wheat

Seed Rate	Fertility levels				
	F_0 0Kg N/ha	F_1 50Kg N/ha	F_2 75Kg N/ha	F_3 100Kg N/ha	Mean
S_1	68.33	75.33	81.33	88.33	78.33
S_2	73.33	80.33	86.33	92.00	83.00
S_3	70.33	76.33	83.33	90.33	80.08

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Mean	70.67	77.33	83.67	90.22	

	S.Em.±	C.D. (p= 0.05)
F	0.15	0.43
S	0.13	0.37
F x S	0.25	0.75

Table 3 Effect of Fertility levels, Seed Rate and their Interaction on Length of spike (cm) at Maturity of Wheat

Seed Rate	Fertility levels				
	F_0 0Kg N/ha	F_1 50Kg N/ha	F_2 75Kg N/ha	F_3 100Kg N/ha	Mean
S_1	10.78	11.70	12.32	12.96	11.94
S_2	11.55	12.14	12.74	13.53	12.49
S_3	11.25	11.85	12.56	13.24	12.22
Mean	11.19	11.90	12.54	13.24	

	S.Em.±	C.D. (p= 0.05)
F	0.02	0.06
S	0.02	0.05
F x S	0.03	0.10

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Table 4. Effect of Fertility levels, Seed Rate and their Interaction on Number of grain per spike at Maturity of Wheat

Seed Rate	Fertility levels				
	F_0 0Kg N/ha	F_1 50Kg N/ha	F_2 75Kg N/ha	F_3 100Kg N/ha	Mean
S_1	43.16	44.71	47.21	49.04	46.03
S_2	44.16	46.57	48.93	50.09	47.44
S_3	43.68	45.40	48.28	49.56	46.73
Mean	43.66	45.56	48.14	49.56	

	S.Em.±	**C.D. (p= 0.05)**
F	0.08	0.23
S	0.07	0.20
F x S	0.13	0.39

Table 5 Effect of Fertility levels, Seed Rate and their Interaction on Grain yield (t/ha) at Maturity of Wheat

Seed Rate	Fertility levels				
	F_0 0Kg N/ha	F_1 50Kg N/ha	F_2 75Kg N/ha	F_3 100Kg N/ha	Mean
S_1	3.45	3.95	4.71	5.27	4.35
S_2	3.83	4.47	5.12	5.70	4.78

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S_3	3.66	4.13	4.93	5.45	4.54
Mean	3.64	4.18	4.92	5.47	

	S.Em.±	**C.D. (p= 0.05)**
F	0.01	0.02
S	0.02	0.07
F x S	0.03	0.13

Table 6 Effect of Fertility levels, Seed Rate and their Interaction on Straw yield (t/ha) at Maturity of Wheat

Seed Rate	**Fertility levels**				
	F_0 0Kg N/ha	F_1 50Kg N/ha	F_2 75Kg N/ha	F_3 100Kg N/ha	Mean
S_1	5.13	5.47	6.08	6.74	5.85
S_2	5.32	5.91	6.58	6.93	6.18
S_3	5.15	5.65	6.35	6.84	6.00
Mean	5.20	5.68	6.34	6.83	

	S.Em.±	**C.D. (p= 0.05)**
F	0.02	0.06
S	0.02	0.05
F x S	0.03	0.10

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Table 7 Effect of Fertility levels, Seed Rate and their Interaction on Harvest Index (%) at Maturity of Wheat

Seed Rate	Fertility levels				
	F_0 0Kg N/ha	F_1 50Kg N/ha	F_2 75Kg N/ha	F_3 100Kg N/ha	Mean
S_1	40.19	41.95	43.67	43.90	42.43
S_2	41.82	43.04	43.80	45.15	43.45
S_3	41.51	42.25	43.72	44.35	42.96
Mean	41.17	42.41	43.73	44.47	

	S.Em.±	**C.D. (p= 0.05)**
F	0.07	0.21
S	0.06	0.18
F x S	0.12	0.36

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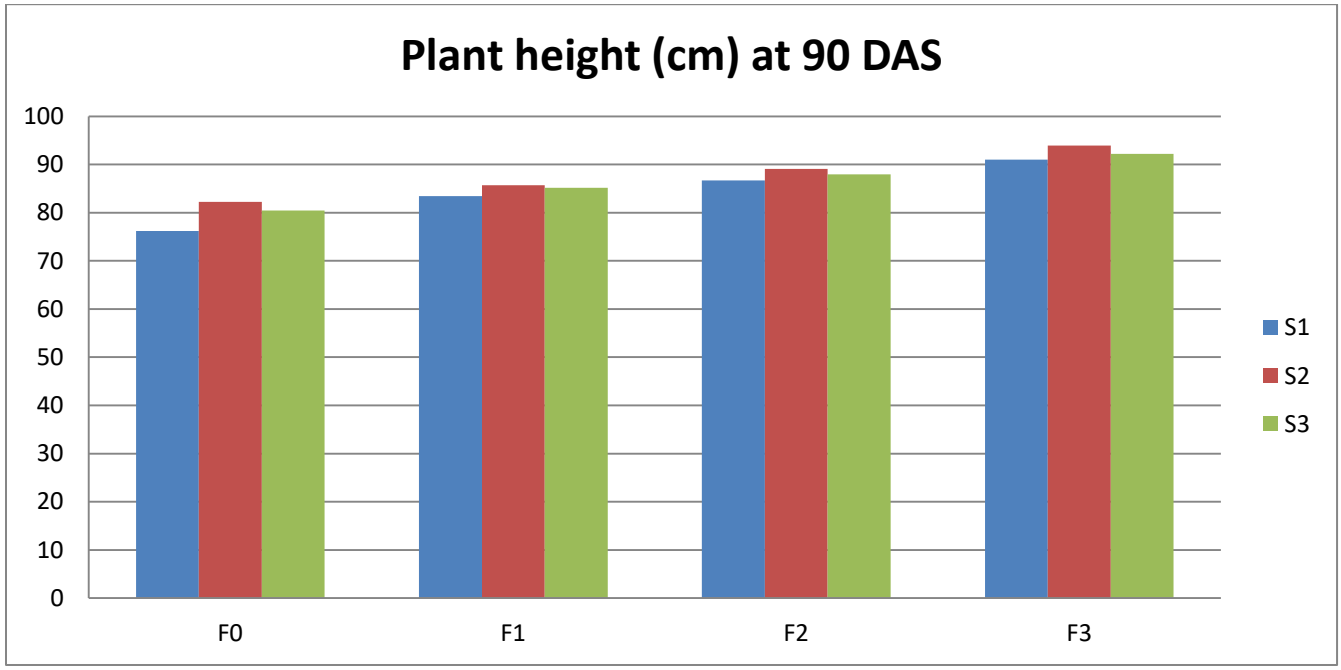

Fig. 1 Effect of Fertility levels and seed rates and their Interaction on plant height (cm) at 90 DAS of Wheat

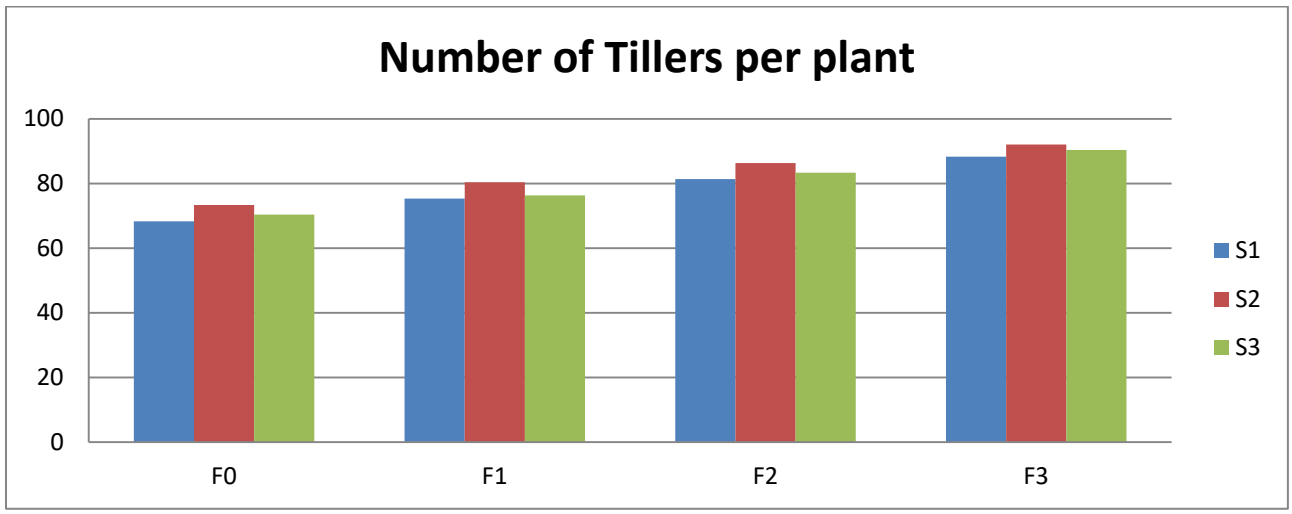

Fig. 2 Effect of Fertility levels and seed rates and their Interaction on Number of tillers per plant at 60 DAS of Wheat.

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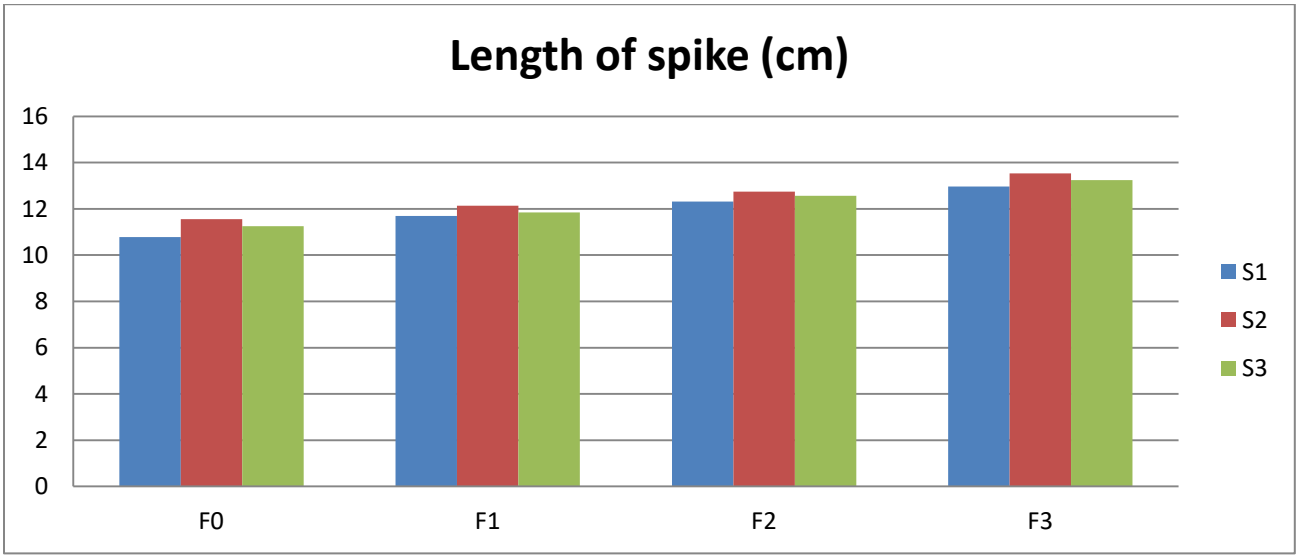

Fig. 3 Effect of Fertility levels and seed rates and their Interaction on Length of spike (cm) at Maturity of Wheat

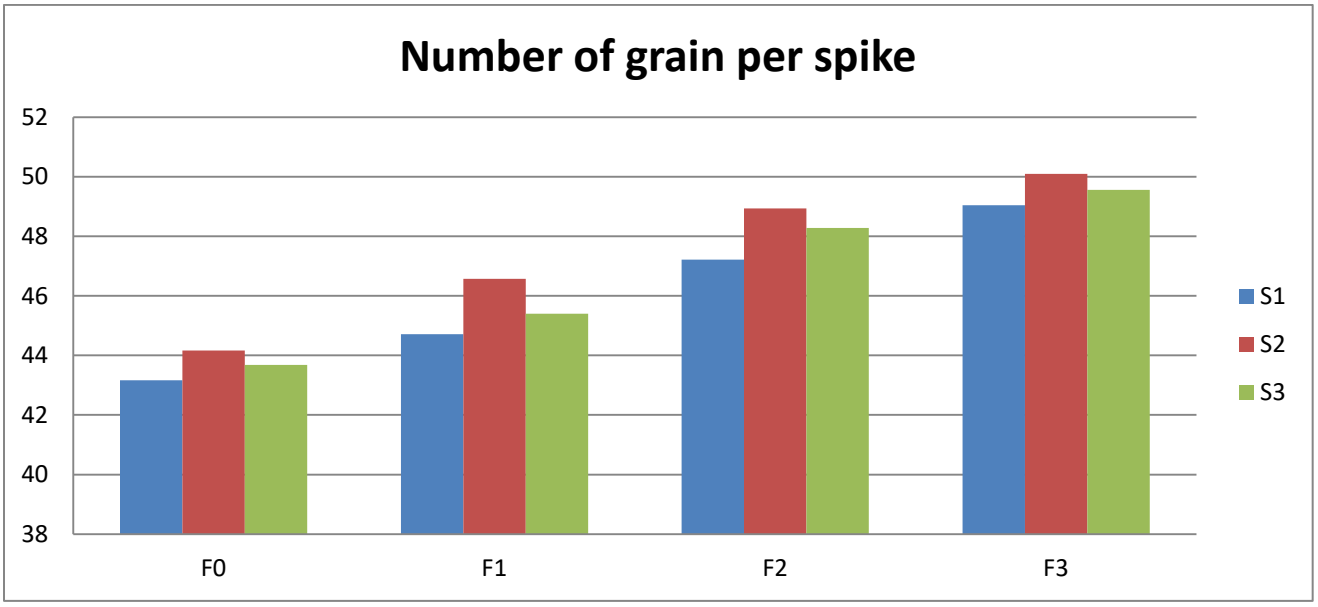

Fig. 4 Effect of Fertility levels and seed rates and their Interaction on Number of grain per spike at Maturity of Wheat.

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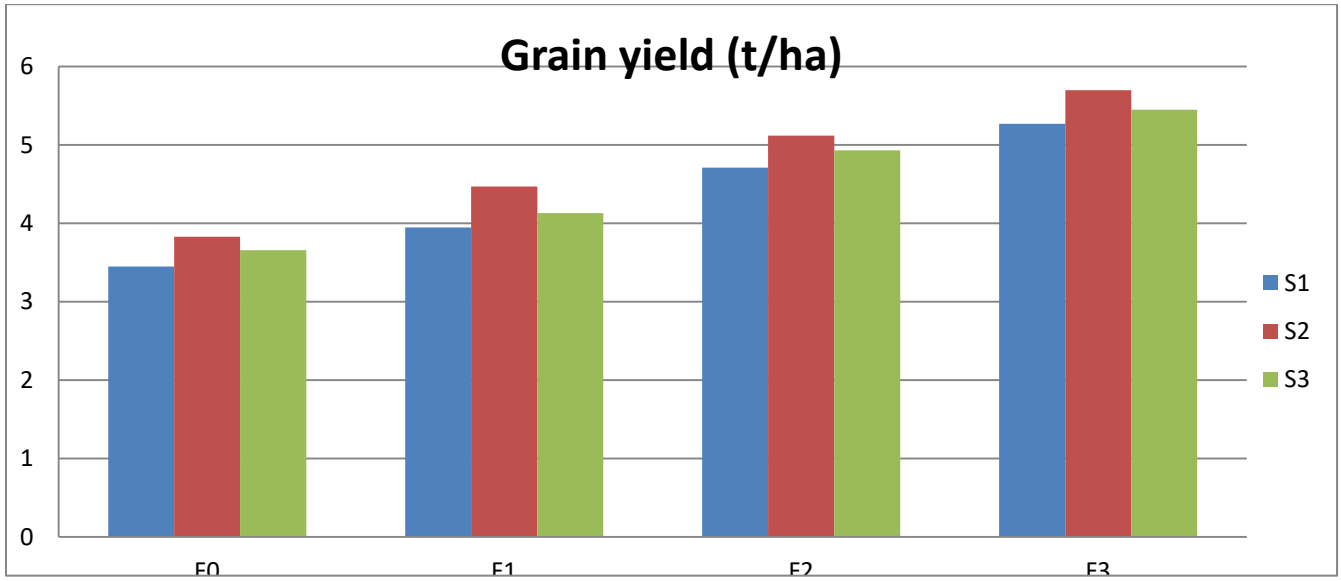

Fig. 5 Effect of Fertility levels and seed rates and their Interaction on Grain yield (t/ha) at Maturity of Wheat

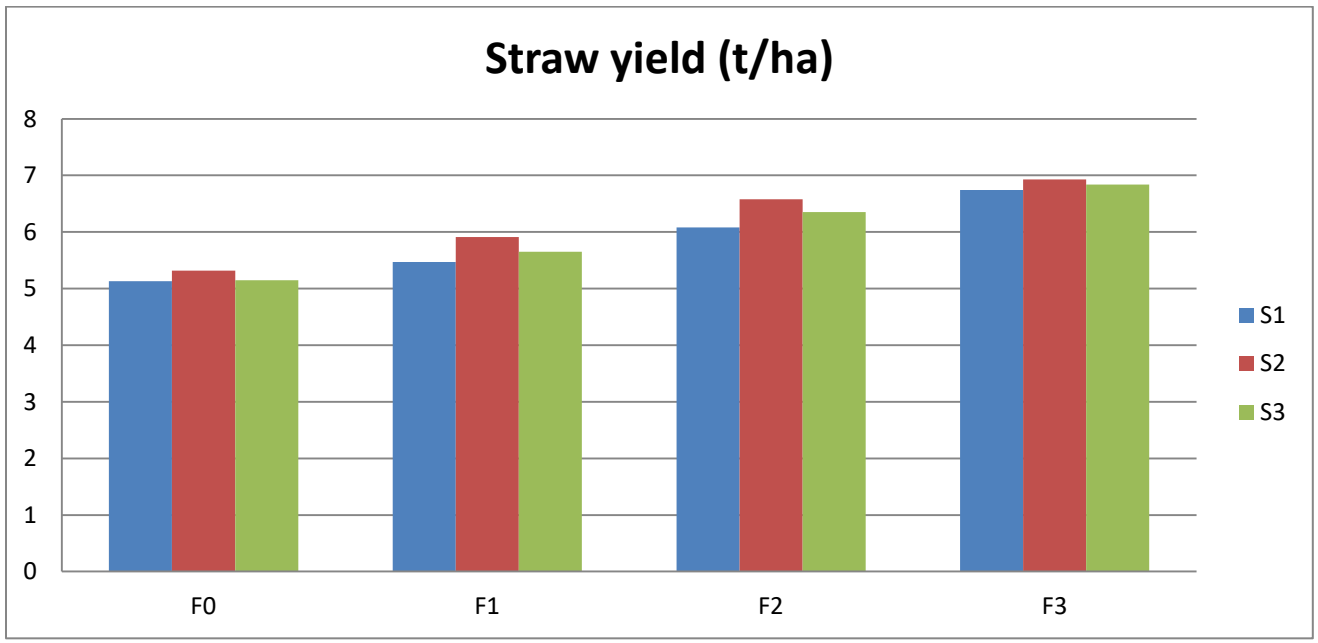

Fig. 6 Effect of Fertility levels and seed rates and their Interaction on Straw yield (t/ha) at Maturity of Wheat.

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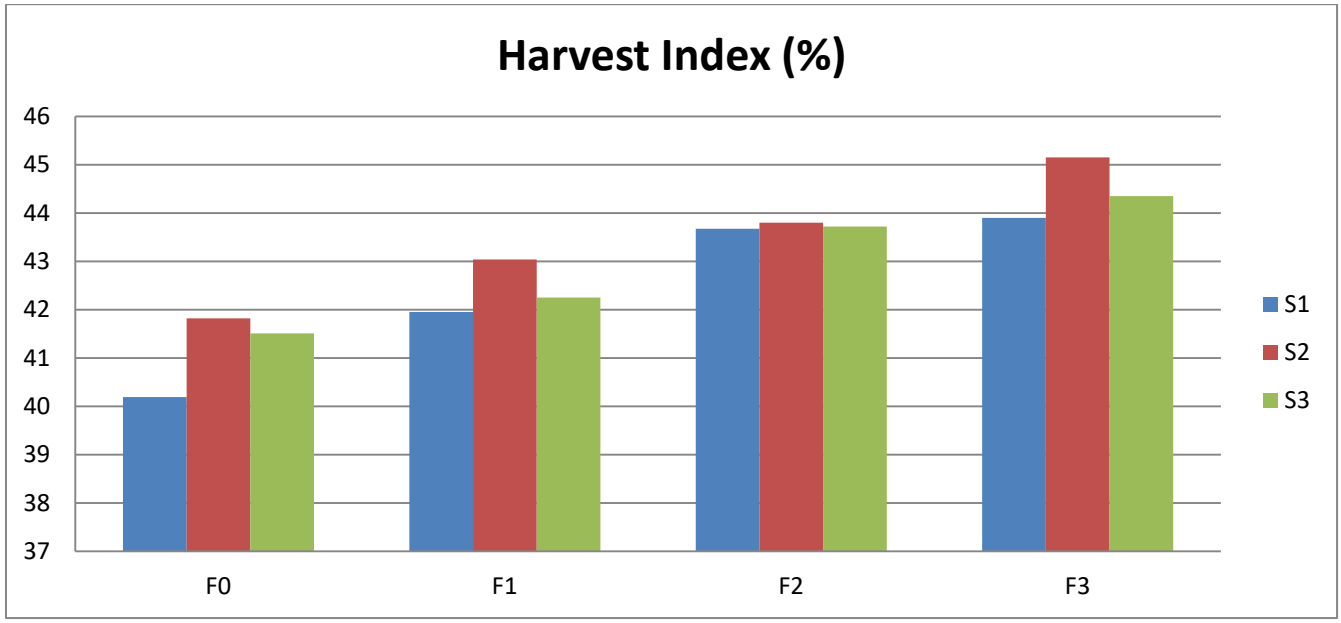

Fig. 7 Effect of Fertility levels and seed rates and their Interaction on Harvest Index (%) at Maturity of Wheat

SUMMARYANDCONCLUSION
CONCLUSION

On the basis of results obtained in present investigation, it could be concluded that according to mean data, fertility levels F_3 (100 kg N/ha) and seed rate S_2 (90kg/h) recorded higher seed yield respectively in wheat. The highest net income (80392.68 Rs/ha) with highest benefit: cost ratio (4.51) was recorded under treatment combination F_3S_2 (100 kg N/haand 90kg/h).

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REFERENCES

Anonymous. 2003. Resource Management. (In) Progress Report, (2002-03), AICWIP, Directorate of Wheat Research, Karnal, pp. 46-50.

Anonymous. 2003a. Quality and Basic Sciences. (In) Progress Report, (2002- 03) AICWIP, Directorate of Wheat Research, Karnal, pp. 19-26.

Anonymous (2019- 20). As per the advanced estimate of the United States department of agriculture and directorate of economics and statistics. USDA, USA.

Hussein, S.M.A. (2005). Effect of supplemental irrigations, seeding rates, and foliar application of potassium and macro-micro elements on wheat productivity under rainfed conditions. Bulletin of Faculty of Agriculture, Cairo University, 56(3): 431-453

Mohamedali, G.H. (1998). Effect of plantuing method and seed rates oin yield of bread wheat in northern Sudan. RACHIS. 7 (1-2): 49-50.

Nayital, S.C. and Sharma, R.K. (1990). Response of rainfed wheat (Triticum aestivum L.) to different seed rate and sowing methods. Indian J. Hill Farming. 3 (1):65-68.

Pali and Sharma, R.K. (1992). Response of wheat to different combinations of fertilizers and planting patterns with seed rate. Haryana Journal of Agronomy, 8: (2): 103-106.

Raun, W. R. and Johnson, G. V. (1999). Improving nitrogen use efficiency for cereal production. Agronomy Journal, 91 (30: 357–363.

Zende N. B., Sethi H. N., Karunakar. A. P. and Jiotode, D. J. (2005). Effect of sowing time and fertility levels on yield and quality of durum wheat genotypes. Res. on Crops. 6(2): 194-196.