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YIELD AND ECONOMICS OF WHEAT AS INFLUENCED BY SYSTEM OF WHEAT INTENSIFICATION

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Abstract

A field experiment was conducted during *rabi* season of 2012-13 at the farm of Wheat Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.), India. The treatments consisted of seed treatment with organic (**T_1** : Treated seed, with **T_2** : non-treated wheat seed) and 4 combinations of row spacings S_1 : Conventional line sowing (18.5 cm), S_2: (10 × 10 cm), S_3: (15 × 15 cm) and S_4: (20 × 20 cm). The experiment was laid out in a factorial randomized blocked design with three replications. The soil was clayey with pH 8.01, containing N, P and K 206.00, 15.86 and 303.43 kg ha^{-1}, respectively. Grain and straw yield of wheat was significantly influenced by varying treatments of seed treatment and spacing. Therefore, economics of wheat crop was found highest in treatment in **T_1** and S_3. While non-significant difference is observed with interactions.

Key words : Wheat (*Triticum* spp.), factorial randomized blocked design (FRBD), grain yield, photosynthetic competition.

Introduction

Wheat (*Triticum* spp.) is a crop plant of gramineae family. It is widely cultivated as staple food crop throughout the world. The outstanding and unique historical feature of wheat cultivation is the prominence in humanity's progressive domination as a colonizer of worlds land surface. It is cultivated extensively in North Western and Central Zones. North West India along with Afghanistan probably forms the centre of origin of bread wheat and India is one of the ancestral lands of this essential food crop. More land is devoted worldwide to the production of wheat than any other crop. USA, Russia, China, Australia, Germany, France, Argentina and India are the main wheat producing countries required in order to survive.

It is grown across a wide range of environments around the world and has the highest adaptation among all the crop species. Wheat is rich source of protein, minerals and vitamins amongst all the cereals. It contributes about 60 per cent of daily protein requirement and more calories to World human diet than any other food crops. In India, more than 80 per cent of the total area of wheat is under *Triticum aestivum* L., where the area under *Triticum durum* Desf and *Triticum dicoccum* Schrank is only 12 per cent and 1 per cent, respectively. In India, wheat is second important food crop, next to rice. It was the crop that brought in the green revolution and paved the way for the food security in India. It contributes about 25 per cent of the total food grain production of the India. Wheat is grown all over the India, from sea level upto elevation of 3568 meters in the Himalaya (Rao *et al*., 1992).

Wheat has relatively high content of 'niacin' and 'thiamine'. It contains the characteristics substance 'gluten', which helps in providing structural framework for the spongy cellular structure of bread and chapatti and other baked products of bakery also abundantly available substrate for mushroom cultivation in our region.

Wheat meets 20 per cent of total food calories for human being (Khichar and Nivas, 2007). Wheat compares well with other important cereals in its nutritive value. It contains more protein than other cereals. Wheat is cheap source of amino acids, whole wheat preparations supply significant amount of Fe, P, Mg, Mn, Cu, Zn and also vitamin B.

In India, wheat is the most important food crop after rice in terms of both area and production which contributes 12% to the world wheat pool. In India during 2012-2013 area under wheat cultivation was 29.05 Mha with annual production of 85.97 M tones with an average productivity of 29.10 q ha^{-1}. In Maharashtra, it occupied as area of 13.25 Mha with production of 22.92 Lakh tones with an average productivity of 13.30 q ha^{-1}, in

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Vidarbha, it occupies 4.23 lakh ha area with average productivity of 17.30 q/ha (Anonymous, 2012-13).

The ultimate yield of wheat crop is controlled by number of genetic and external factors. An optimum level of single factor will not cause any appreciable increase in the yield itself, but a combination of factors contributes to the ultimate yield of wheat. It is well recognized that by keeping proper row spacing and input like seed treatment, fertilizer and seed rate etc. have an effective role in increasing the yield of crops. Wheat is generally planted by broadcast method by most of the farmers in our country, only progressive farmers and research scientists use line sowing. Now a day due to infestation of weeds, it has become important to sow the crops in lines with suitable proper row spacing, which besides facilitating inter-culture and convenient herbicide application for effective and effective weed control may also help in intercropping and reducing the seed rate per hector without any adverse effect on the final grain yield.

Due to the above mention usefulness of proper row spacing, it may be helpful to increase and improve the yield component of wheat crop. Maintenance of optimum row spacing can help to optimize tillering capacity and may ensure better wheat yield (Thorsted *et al*., 2006).

Optimal row spacing plays crucial role to improve the crop productivity as plants growing in too wider rows may not efficiently utilize the light, water and other nutrient resources, whereas growing in too narrow rows may result in severe inter-row competition (Kirkland, 1993).

Competition for light penetration, water and essential nutrients availability can thus be manipulated to enhance production potential of wheat by sowing under apposite row spacing (Chen and Neill, 2006).

Moreover, row spacing may modify the plant architecture, photosynthetic competition of leaves and dry matter portioning in field crops (Samani *et al*., 1999).

Materials and Methods

A field experiment was conducted during *rabi* season of 2012-13 at the farm of Wheat Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.), India. The climate of experimental site sub-tropical and semi arid with extreme weather condition having hot and dry summer, cold winter, where maximum temperature goes upto 45^{0}C. The mean annual rainfall of Akola is 820 mm.

The experiment on Vertisol having organic carbon 6.9 g kg^{-1}, pH 7.48, EC 0.25 dSm^{-1}, available N, P and K 228.32, 24.80 and 369.19 kg ha^{-1}, respectively. The experiment consisting of eight treatments combination was carried out in three times replicated with factorial randomized block design. The treatments were- (**T_1**: Treated seed, with **T_2**: non-treated wheat seed) and 4 combinations of Row Spacing S_1: Conventional line sowing (18.5 cm), S_2: (10 × 10 cm), S_3: (15 × 15 cm) and S_4: (20 × 20 cm).

The crop sown on fourth week of December 2012 with a plot size of 1.5 × 3 m. The cultivation practices were followed as per the Guidelines of Crop Production Guide of Dr. Panjabrao Deshmukh Krishi Vidyapeeth Agriculture University. The fertilizer sources were urea for N (46% N), single super phosphate for P (16% P) and muriate of potash for K (60% K_2O). Full dose of phosphorus, muriate of potash and half dose of N were applied to pearl millet as basal dose at the sowing. The remaining dose of N was top dressed at 30 days after sowing.

Results and Discussion

Yield studies

Data in concern of grain, straw yield and grain to straw ratio in table 1 and graphically depicted in fig. 1.

Grain yield (kg ha^{-1})

Grain yield of wheat was significantly influenced by spacing and seed treatment.

Effect of seed treatment

Effect of seed treatments on grain yield was significant. Treatment **T_1** recorded significantly superior over treatment **T_2**. Higher availability due to organic sources may be one of the reasons for increasing grain yield.

Effect of spacings

Effect of spacing treatments on grain yield was significant. Treatment S_3 (15 × 15 cm) was significantly superior over S_4 (20 × 20), S_2 (10 × 10 cm) and S_1 (18.5 cm). The treatment S_4 (20 × 20 cm) was recorded at par with a treatment S_2 (10 × 10 cm) while, it was significantly superior over S_1 (18.5 cm). However, sowing of wheat at treatment S_2 (10 × 10 cm) produced more grain over S_1 (18.5 cm). Wheat sown under narrow row spacing, especially 15 × 15 cm, performed better with superior grain yield ha^{-1} primarily due to increase in ear head plant^{-1}. Even significant increase in grain number and size in wider rows could not compensate the decrease in earhead plant^{-1} resulting in low grain yield. Similar results have been reported by Malik *et al*. (1996) and Khan *et al*. (2001).

Interaction effect

Interaction effect between spacing and seed treatment was statistically non significant.

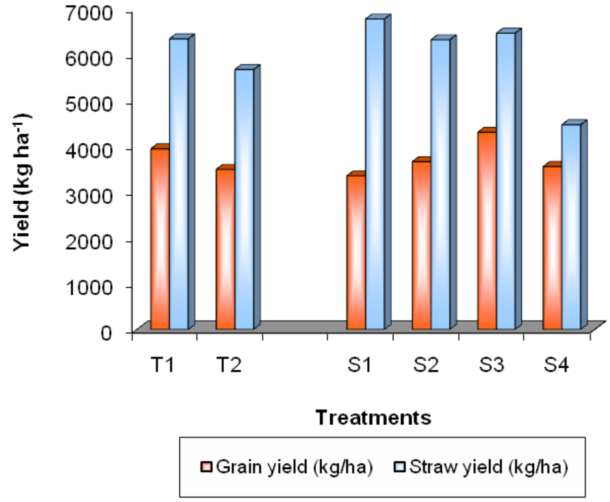

Fig. 1 : Grain and straw yield (kg ha^{-1}) as influenced by various treatments.

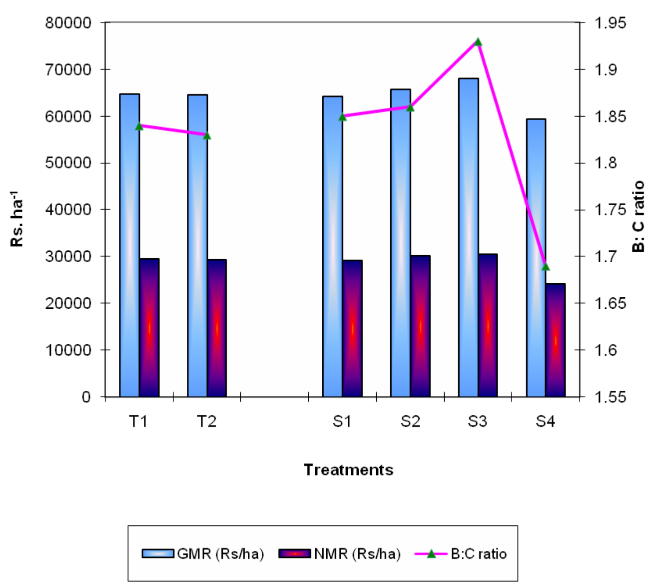

Fig. 2 : GMR, NMR and B:C ratio as affected by various treatments.

Straw yield (kg ha^{-1})

Straw yield of wheat was significantly influenced by spacing and seed treatments.

Effect of seed treatment

The seed treatments significantly influenced the straw yield. Treatment $\mathbf{T_1}$ was recorded higher straw yield kg ha^{-1}, it was statistically superior over treatment T_2. It might be due to cow urine and jaggary treatment, which increase tillering ability and growth characteristics of plant.

Effect of spacings

Effect of spacing was significantly influenced the straw yield. Treatment S_1 (18.5 cm) recorded higher straw yield (kg ha^{-1}), which is significantly superior over treatment S_2 (10 × 10 cm), S_3 (15 × 15 cm) and S_4 (20 × 20 cm). The treatment S_2 (10 × 10 cm) was recorded at par with S_3 (15 × 15 cm) while, it was significantly superior over S_4 (20 × 20 cm). However, sowing of wheat at treatment S_3 (15 × 15 cm) produced more straw yield over S_4 (20 × 20 cm). Higher straw yield noted in narrow row spacing was the direct consequence of increasing plant population. This result is in agreement with the findings of Malik *et al*. (1996) and Ali *et al*. (2010).

Interaction effect

Interaction effect between spacing and seed treatment were statistically non-significant.

Grain to straw ratio

Data recorded grain to straw ratio showed that grain to straw was influenced significantly due to various treatments.

Effect of seed treatment

The treatment $\mathbf{T_2}$ recorded highest grain to straw ratio (0.91). Treatment $\mathbf{T_1}$ recorded significantly lowest grain to straw ratio (0.75).

Effect of spacing

The grain to straw ratio was influenced by different spacing. The highest grain to straw ratio 0.99 was obtained in S_3 (15 × 15 cm) sowing followed by 0.83 when sowing was done at S_4 (20 × 20 cm) and 0.76 when sowing was done at S_2 (10 × 10 cm) and S_3 (15 × 15 cm).

Economics of treatments

Data in respect of gross monetary returns, net monetary returns and B : C ratio are presented in table 2 and graphically depicted in fig. 2.

Gross monetary returns

Data in the table 2 revealed that gross monetary returns was affected significantly due to various treatments and the average gross monetary return was Rs. 64573 ha^{-1}.

Effect of seed treatment

Effect of seed treatment could not reach the level of significance.

Effect of spacings

Spacing treatments significantly influenced the gross monetary return. Treatment S_3 (15 × 15 cm) recorded highest gross monetary return of Rs. 68081 ha^{-1} and significantly higher gross monetary return over S_2 (10 × 10 cm), S_4 (20 × 20 cm) and S_1 (18.5 cm). Similarly, S_2 (10 × 10 cm) was at par with S_1 (18.5 cm) and superior over S_4 (20 × 20 cm).

Interaction effect

Interaction effects were non significant.

Table 1 : Grain yield, straw yield, (kg ha^{-1}) and grain to straw ratio as influenced by various treatments during 2012-13.

Treatments	Grain yield (kgha^{-1})	Straw yield (kgha^{-1})	Grain to straw ratio
Seed treatment			
$\mathbf{T_1}$ (Treated)	3942	6339	0.95
$\mathbf{T_2}$ (Untreated)	3491	5671	0.81
S.Em. ±	133	219	0.04
CD P = 0.05	404	665	0.122
Row spacing			
S_1 (18.5 cm)	3353	6772	0.76
S_2 (10x10 cm)	3661	6319	0.76
S_3 (15x15 cm)	4300	6463	0.99
S_4 (20x20 cm)	3553	4466	0.83
S.Em. ±	188	310	0.05
CD P= 0.05	571.53	940	0.17
Interaction (T × S)			
S.Em. ±	266.51	438	0.08
CD P = 0.05	NS	NS	NS
GM	3854	6145	0.78

Table 2 : GMR (Rs. ha^{-1}), NMR (Rs. ha^{-1}), cost of cultivation (Rs. ha^{-1}) and B : C ratio as influenced by various treatments.

Treatments	GMR (Rs. ha^{-1})	NMR (Rs. ha^{-1})	Cost of cultivation (Rs. ha^{-1})	B:C Ratio
Seed treatment				
$\mathbf{T_1}$ (Treated)	64683	29434	35250	1.84
$\mathbf{T_2}$ (Untreated)	64464	29314	32150	1.83
S.Em. ±	207	208	-	-
CD P = 0.05	NS	NS	-	-
Row spacing				
S_1 (18.5 cm)	64260	29079	35200	1.85
S_2 (10 × 10 cm)	65636	30060	35200	1.86
S_3 (15 × 15 cm)	68079	30437	35200	1.93
S_4 (20 × 20 cm)	59320	24120	35200	1.69
S.Em. ±	294	294	-	-
CD P= 0.05	891	892	-	-
Interaction (TXS)				
S.Em. ±	415	416	-	-
CD P = 0.05	NS	NS	-	-
GM	64573	29374	34700	1.84

Net monetary return

Data in table 2 revealed that the net monetary return was affected significantly due to various treatments and the average gross monetary return was Rs. 29374 ha^{-1}.

Effect of seed treatment

Effect of seed treatment could not reach the level of significance.

Effect of spacings

Spacing treatments significantly influenced the net monetary return. Treatment S_3 (15 × 15 cm) recorded significantly highest net monetary return of Rs. 30437 ha^{-1} over treatments S_2 (10 × 10 cm), S_4 (20 × 20 cm) and S_1 (18.5 cm). Treatment S_2 (10 × 10 cm) was also recorded significantly higher net return over S_4 (20 × 20 cm) and S_1 (18.5 cm).

Interaction effect

Interaction effects were non significant.

B: C ratio

Data in the table 2 revealed that B : C ratio affected significantly due to various treatments and the average B : C ratio was 1.84.

Effect of seed treatment

Effect of seed treatment could not reach the level of significance.

Effect of spacing

Spacing S_3 (15 × 15 cm) was recorded higher B:C ratio of 1.93 followed by S_2 (10 × 10 cm), S_4 (20 × 20 cm) and S_1 (18.5 cm) during the course of investigation. Minimum B : C ratio was found to be 1.69 for S_1 (18.5 cm).

Interaction effect

Interaction effects were non significant.

Conclusion

It can concluded that grain and straw yield of wheat was significantly influenced by varying treatments of seed treatment and spacing. Therefore, economics of wheat crop was found highest in treatment in $\mathbf{T_1}$ and S_3.

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