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Evaluating the performance of wheat varieties under late sown irrigated condition in Bundelkhand zone

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Abstract

Delay in time of sowing in Rice-wheat cropping system is perhaps the one of the major factors responsible for low crop yield. Farmers were also practiced late sown wheat due to late release of canal or wheat grown after a catch crop of Toria during August – December. In this study, performance of wheat cultivars (viz. MP-4010, HD-2864, Lok-1, K-7903 and GW-273) sown on December 10 to 25 was evaluated. Crop establishment was impaired of timely sown cultivar (GW-273) when sowing was delayed owing low temperature, which resulted in poor crop stand and ultimately the final yield. With delay planting, wheat cultivar MP-4010 out yielded due to short duration and tolerance to temperature stress at reproductive phase (32-39^{0}C) followed by K-7903, Lok-1 and HD-2864.

Key Words : Late sown condition, Temperature Tolerance, Wheat cultivar

I. INTRODUCTION

Wheat (*Triticum astivum* L.,) has a prominent position among the cereals that supplement nearly one third of the total world population's diet by providing half of the dietary protein and more than half of the calories (Dhanda *et al.,* 2004). Wheat is considered to be one of the main crops in Bundelkahnd region as well as in the Madhya Pradesh and India. The total area under the crop is about 29.8 million hectares in the country with only 13.53% share of production (FAOSTAT and IGC reports 2011-12). The total area under wheat in MP is 4.89 million ha with 10.58 million tonnes production and 2164 kg/ha productivity, wheat has significant area about 1.35 million ha with average productivity of 2811 kg/ha (2011-12) in Datia district of Bundelkhand. Enormous efforts were carried out to reduce the vast gap between production and consumption of wheat. Many factors contribute in increasing yield, such as early and on –time sowing (Akhtar *et al*., 2006; Sattar *et al.,* 2010), Seed quality (Farooq *et al.,* 2008), availability of high yielding varieties (Hussain *et al.,* 1998), judicious use of inputs such as fertilizers and irrigation (Mullaa *et al*., 1992; Kibe *et al.,* 2006) and effective weed management (Abouziena *et al.,* 2008).

The level of self – sufficiency will not be achieved unless researchers manage to make better use of resources and new technology transfer. There is a concerted effort to significantly improve the grain yields of wheat. Variety selection may be one major source of productivity gains.

In Bundelkhand most of the farmers are practiced late sown wheat due to late release of canal or wheat grown after a catch crop of Toria during September – December. Due to both the reasons productivity of wheat crop is reduced significantly. Hobbs and Morris (1996) observed a 1% decrease for each day that wheat sowing was postponed after the optimum sowing date (15-20 November).Keeping the view to improve the productivity of wheat in late or very late condition, this study was arranged purpose was to evaluate the new varieties on farmer's field under late sown irrigated condition of Bundelkhand region.

II. MATERIALS AND METHODS

A study was arranged to test five varieties in late sown irrigated condition in Datia district of Bundelkhand region in Madhya Pradesh. The experiment were conducted on 30 locations at farmers field for two years from 2011-12 to 2012-13. The study area is situated between 78^0 27' 39.28" E longitude to 25^0 39' 25.24" N latitude; and characterized with semi and sub tropical climate with extremes of temperature in summer 47 ^{0}C and in winter 2 ^{0}C.

These trials were planted on 30 farmer's field in the area of 0.4ha each. The well adopted variety GW-273 was compared with others in the area of 1000 sq. meter area as local check. The sowing was done by ferti-seed-drill during both years between 20 -25 December. A basal dose of 60 kg/ha N, 60 kg/ha P_2O5 and 40 kg/ha K_2O was applied at the time of planting every year. The rest 60 kg/ha N is applied in two split doses after 1st and 2nd irrigation. Seed rate was kept constant at 120 kg/ha for all the treatments. Spray of Sulphosulfuran @ 35 gm a.i. / ha had been done for weed control at 25-30 days after sowing. Each plot was considered as a replication for statistical analysis under randomized block design. Weekly maximum and minimum temperature were collected during the growing period (Fig. 1 and Fig 2).

III. RESULTS AND DISCUSSION

Grain Yield (q/ha)

Grain yield of different varietal treatments are presented in Table-1. Results revealed that there is significant higher grain yield recorded from all four late sown verities of wheat in comparison to timely sown high yielding variety (GW-273). Recently released late sown variety MP-4010 gave maximum grain yield (36.82 q/ha) whereas, timely sown variety GW-273 perform 24.5 per cent lower yield (27.79 q/ha) under late sown condition. The superiority of MP-4010 in grain yield is due to that it has number of grains per spike.

Straw Yield (q/ha)

Data revealed that main effect of sowing with varieties were statistically significant for straw yield (Table-1). Straw yield was also recorded significant higher under MP-4010 and HD-2864 in comparison to check (timely sown variety GW-273). Straw yield of cultivar Lok-1 (45.64q/ha) and K-7903 (45.23 q/ha) were recorded at par and significantly higher than timely sown variety GW-273 (36.04q/ha).

1000 grain weight (gm)

Data showed that weight of 1000 grains of variety GW-273 was reduced due to time of sowing (table-1). Data clearly showed significant higher 1000 grain weight of all four late sown varieties MP 4010, HD2864, Lok-1 and K 7903 that is 45.43gm, 42.59gm, 44.51gm and 45.20gm respectively in comparison to timely sown variety GW 273 which is 36.04gm. 1000 grain weight was recorded at par under all four late sown varieties except HD-2864 (42.59gm)

Number of grain per spike

Data presented in table-1 showed that there is significant higher number of grain per spike were recorded under all four late sown varieties in comparison with control treatment. The all four tested varieties MP-4010, HD-2864, Lok-1 and K 7903 recorded 40.92, 39.78, 40.00 and 40.26 grains per spike respectively; which was significantly higher than GW-273 (38.50 grain/spike).

Plant Height (cm)

Plant height was at par in all the treatment except MP-4010 (85.68 cm) which was significantly higher than control treatment GW-273 (Table-1). Plant height was recorded at par under Lok-1, HD-2864, K-7903 and GW-273; 85.67, 84.36, 83.31 and 81.32 respectively. Data showed that Plant height was greatly influenced by time of sowing.

Length of spike (cm)

Length of spike was recorded statistically significant in all treatment over control (table-1). Length of spike was recorded maximum under MP-4010 (9.54cm) and minimum under GW-273 (8.48 cm), it is because of less time availability for reproduction to timely sown variety GW-273 and impact of temperature during early growth phase.

Economics

Data presented in Table-2 reported that economics of different treatment was sown similar trend as yield and yield attributes. Maximum gross return was obtained under MP-4010 (Rs. 47866/ha) followed by K-7903 (Rs. 46046/ha), Lok-1 (Rs. 43095/ha), HD-2864 (Rs. 41405/ha) and GW-273 (Rs. 36127/ha). Net return (Rs/ha) and Benefit Cost ratio were also shown similar pattern.

The early sowing resulted in better development of the grain due to longer growing period. As timely sown wheat had more time for the dry matter accumulation to produce the higher grain yield (Spink *et al.* 2000; Shahzad *et al.*, 2002). The short growing season cultivars like MP-4010 gave better yield in late sowing. These results suggest that under late sowing early germination and seedling growth are very important for better stand establishment of the wheat crop. Cultivar MP-4010 gave maximum grain yield this might be due to the ability to tolerate low temperature during the germination. The similar result of above study was recorded by Dokuyucu *et al*., (2004). Grain yield of control treatment GW-273 was reduced due to the suboptimal temperature during germination and supra optimal temperature during the reproductive growth. It was also found by Sattar *et al*., (2010). Benjamin (1990); Stewart *et al.*, (1990) reported that low temperature during the germination and early seedling has detrimental effect on the crop establishment and productivity.

Under late sowing cultivars showed the significant difference for all yield and yield contributing parameter. Cultivar MP-4010 produced the maximum number of grain per spike, spike length and 1000 grain weight, which might be due to more production of dry matter and ability to tolerant heat stress during reproductive phase. Due to sensitivity to high temperature GW-273 produced the low grain number and weight. High temperature induces modifications in plants may be direct as on existing physiological process or indirect in changing the pattern of development (Downton and Slatyer 1972)

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Low grain yield in late sown crop GW-273 is resulted from thermal stress due to higher temperature (>_32^{o} c), which prevailing during grain filling. High temperature stretches the period of grain filling resulting in reduced development of grain ultimately decreasing the grain number and grain weight in wheat crop (Guillioni *et al.*, 2003). Overall, it seems that reproductive phase (of wheat crop) is hampered by heat stress, which affects the fertilization process leading to reduced crop yield.

IV. CONCLUSION

It is concluded from this study that late sown verities performed better in Black gram-Toria-Wheat cropping system. Wheat variety MP-4010 was economical in late sown irrigated condition. This study was also elaborating the highly remunerable cropping system of Black gram –Toria – Wheat. It is also helpful to increase cropping intensity under irrigated production system of Bundelkhand zone.

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Table 1: Performance of different wheat varieties on different parameters
(Pooled data of Rabi 2011-12 and 2012-13)

variety	Grain yield (q/ha)	Straw yield (q/ha)	1000 grain weight (gm)	length of spike (cm)	Number of grain/ spike	Plant height (cm)
MP 4010	36.82	47.85	45.43	9.54	40.92	85.68
HD 2864	31.85	41.96	42.59	9.03	39.78	84.36
Lok 1	33.15	45.64	44.51	9.24	40.00	85.67
K7903 (Halna)	35.42	45.23	45.20	9.34	40.26	83.31
GW 273	27.79	36.04	36.04	8.48	38.50	81.32
SE (m)+,-	0.481	0.396	0.369	0.136	0.371	0.701
CD at 5%	1.440	1.187	1.105	0.409	1.113	2.103

Table 2: Economics of different wheat varieties
(Pooled data of Rabi 2011-12 and 2012-13)

Variety	Gross return	Cost of Cultivation	Net Return	B:C Ratio
MP 4010	47866	11500	36366	4.16
HD 2864	41405	11500	29905	3.60
Lok 1	43095	11500	31595	3.74
K 7903 (Halna)	46046	11500	34546	4.00
GW 273	36127	11500	24627	3.14

Figure