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Comparative performance of wheat cultivars in Muktsar district of Punjab

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ABSTRACT : A field experiment was conducted during *Rabi* 2014-15, 2015-16 and 2016-17 at Krishi Vigyan Kendra, Sri Muktsar Sahib (Punjab), to find out the best suitable wheat variety for the area. The district has slightly high salinity soils and high water table area. Nine different wheat varieties were tested *i.e.* PBW 725, PBW 677, HD 3086, WH 1105, HD 2967, PBW 621 and PBW 550 were timely sown and PBW 658 and PBW 59 were late sowing varieties. Varieties HD 3086, WH 1105 and PBW 550 take comparatively less days for maturity as compared to other varieties. Due to the short duration of these varieties the climate change has less effect in terms of yield. From all timely sown varieties HD 3086 (51.5 q/ha) produced significantly higher grain yield, which was statistically at par with PBW 725 (51 q/ha) and WH 1105 (51 q/ha) as compared to lower grain yield recorded with PBW 677 (48.75 q/ha), HD 2967 (46.25 q/ha), PBW 621(49 q/ha) and PBW 550 (48.25 q/ha). Among late sown varieties PBW 658 produced comparatively more yield than PBW 590 variety. Grain yield of HD 3086, PBW 725, WH 1105 varieties were higher due to higher number of effective tiller per unit area and higher number of grains per ear of respective variety. These varieties are most suitable for the area as these were less affected due to salinity.

KEY **W**ORDS : Cultivar, Effective tiller, Punjab, Wheat, Yield

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Wheat (*Triticum aestivum,* L.) is one of the most important crops cultivated in India. It is a major source of carbohydrates for human being while its straw is important part of livestock feed. Rapid increase in wheat consumption due to high population growth is projected to outpace the whole domestic production. Its grain contains carbohydrates 60-80%, protein 8-15 %, inorganic ions 1.5-2.0%, fat 1.5-2.0% and vitamins such as B complex and E (Schellenberger, 1996) . Due to the wider adaptability of wheat crop, it can be grown under diverse agro-ecological conditions (Munjal and Dhanda, 2005). To meet the increasing demand of food grains, it is desired to have a higher yield per unit area. The number of factors including land preparation, time of sowing, fertilizer application, irrigation scheduling and weed management are responsible for the variation in grain yield of wheat, but all these factors are agronomic and which are greatly influenced by rainfall, temperature and humidity (Malik *et al.*, 2009). However, climate changes, produce large annual variations in productivity of wheat crop (Kaur and Behl, 2010). Due to climate change, the incidence of extreme weather events has increased. Extremely high temperatures at grain filling stage are the factor causing the greatest loss for crop production (Balla *et al*., 2009).

With the existing semi-dwarf high yielding varieties,

there is potential of obtaining higher crop productivity by adopting appropriate seed rates, sowing date, N and P rates (Campbell *et al.,* 1991). These are the important management factor for improved wheat yield because it is under the farmer's control in most cropping systems (Nizamani *et al.,* 2014). The introduction of new varieties with high yield potential and wide range of its adaptability is an important factor for enhancing wheat production (Alam *et al*., 2006). Different varieties respond differently to the varied environment and hence differ in yield. Cultivars differed significantly due to difference in number of tillers m^{-2}, 1000-grain weight and grain yield (Akmal *et al*., 2000; Jan *et al*., 2003 and Irfaq *et al*., 2005). Besides this, soil salinity and ground water resource are major problems for irrigated agriculture in many parts of the world. Excess amount of salt in the soil adversely affects the growth and development of plant. Nearly 20% of the world's cultivated area are affected by salinity (Goudarzi and Pakniyat , 2008*;* Sattar *et al.,* 2010 and Kumar *et al.,* 2016).

In Punjab, wheat currently occupies an area of 34.95 lakh hectare with production of 176 lakh tons with an average yield of 50.46 q ha^{-1} (Anonymous, 2017). The Sri Muktsar Sahib district is major wheat growing district of Punjab. The district faces lot of biotic and abiotic stresses. The major abiotic stresses are high salinity, water logging, high water table, poor underground water quality. Among all abiotic stresses, salinity is the major factors of restricting productivity of wheat crop in the district. To avoid these problems the development of such wheat varieties, which are high yielding and resistant to biotic and abiotic stresses must be included. These varieties give different yield in different areas. The soil and irrigation water of Sri Muktsar sahib is totally different from whole of the Punjab state. The district contains high salinity and water logged area. The present study was, therefore, designed to determine the yield potential of some newly introduced varieties.

RESEARCH PROCEDURE

A field experiment was conducted during *Rabi* 2014-15, 2015-16 and 2016-17 at Krishi Vigyan Kendra, Sri Muktsar Sahib (Punjab), to find out the best suitable variety of wheat for the area. The geographical location of experimental site has reference to 74°30'32" east longitude, 30°26'35" North latitude. The area is characterized by semi-arid type of climate and cold winters during December-January. The mean maximum and minimum temperatures show considerable fluctuations during different parts of the year. The soil was sandy loam, slightly alkaline in reaction (pH 8.3), high EC (0.948 dS/m), low in available organic carbon (0.32 %), medium in available phosphorus (15.8 kg/ha) and high in available potassium (525 kg/ha). Rice was grown as the previous *Kharif* crop in this experimental plot during all the three year. Total nine number of wheat varieties were sown. Out of these nine varieties seven were timely sowing (PBW 725, PBW 677, HD 3086, WH 1105, HD 2967, PBW 621 and PBW 550) and two were late sowing varieties (PBW 658 and PBW 590). All varieties were tested for in the three years of the study. All these varieties are recommended by Punjab Agricultural University, Ludhiana for all type of Punjab soil and conditions. During *Rabi* 2014-15, date of sowing for timely sown varieties is 10 November and late sown varieties is 28 November. During 2015-16 and 2016-17, date of sowing for timely sown varieties was 15 November and 8 November, whereas for late sown varieties it was 30 November and 27 November. The experimental trials were harvest in the month of April according to the maturity of the variety during the study period of three years. The experiments were carried out with 100 kg seed rate/ha and all the other agronomic practices were kept optimum in the experiment. Nitrogen was applied according to the soil test basis and irrigations were applied according to the requirement of the crop. The data on number of days taken for maturity, number of effective tillers per square meter, plant height, number of grains per ear, 1000 grain weight, grain yield and straw yield were collected through field observations. Collected data were further analyzed by using appropriate statistical tools.

RESEARCH ANALYSIS AND REASONING

The findings of the present study as well as relevant discussion have been presented under following heads :

Days taken to maturity :

Due to climate change, the duration of wheat varieties in Punjab is a major factor for concern. Among timely sown varieties, in all three years, PBW 677 (158.7), and PBW 621 (158.3) takes comparatively more days

for maturity as compared to HD 2967 (156.3), PBW 725 (155.3) and WH 1105 (153.7). However, variety HD 3086 (150) and PBW 550 (148.3) taken less days for maturity as compared to all timely sown varieties. Late sown varieties PBW 658 and PBW 590 take 135.7 and 130.0 (Table 1) days for maturity, respectively.

Plant height :

Although the yield of the wheat crop is not direct relation with the plant height but it is directly proportion with the comparative straw yield of wheat crop. More is the plant height of certain variety more will be the comparative straw yield. If the height of wheat variety is more then it will also prefer to lodging. In this experimental study PBW 677 variety recorded significantly higher plant height (105.6 cm) from HD 2967 (99.7 cm), PBW 621 99.4 cm and PBW 725 (97.1 cm). All the other varieties had significantly lesser height as compared to these varieties (Table 1).

Number of effective tillers per m^2 :

Both grain and straw have directly relation with the number of tillers. As the variety having more number of tillers, it will also contribute more toward grain and straw yield. Among all the varieties PBW 725 (450.1), HD 3086 (449.2), HD 2967 (435.1), PBW 621 (432.6) produced significantly higher number of effective tiller per unit area as compared to all other varieties (Table 1).

Number of grain/ear and 1000 grain weight :

Both these parameters are yield contributing characters. Number of grain/ear was significantly higher in wheat variety WH 1105 (61.7), HD 3086 (60.9) and PBW 725 (60.4) as compared to HD 2967, PBW 677, HD 2967 and PBW 2621 (Table 2). Variety PBW 590 produced significantly lesser grain/ear among all wheat varieties. However, all the different varieties failed to produce any significant effect on the 1000 grain weight (Table 2).

Table 1 : Performance of different varieties on days taken to maturity, plant height and number of tillers

Variety	Days taken to maturity				Plant height (cm)				No. of tillers/m^2			
	2014-15	2015-16	2016-17	Average	2014-15	2015-16	2016-17	Average	2014-15	2015-16	2016-17	Average
PBW 725	158	152	156	155.3	96.3	97.2	97.8	97.1	432	455	463.3	450.1
PBW 677	162	154	160	158.7	104.7	105.6	105.8	105.4	436	430	406.7	424.2
HD 3086	152	146	152	150.0	94.7	94.6	95.4	94.9	456	455	436.7	449.2
WH 1105	158	149	154	153.7	95.7	96.4	96.6	96.2	436	425	418.3	426.4
HD 2967	160	151	158	156.3	99.3	100.2	99.6	99.7	432	460	413.3	435.1
PBW 621	162	155	158	158.3	99.7	100.8	97.6	99.4	436	435	426.7	432.6
PBW 550	148	150	147	148.3	82.3	83.2	82.8	82.8	428	415	443.3	428.8
PBW 658	137	134	136	135.7	88.7	87.6	86.4	87.6	436	425	423.3	428.1
PBW 590	128	130	132	130.0	82.7	85.4	81.6	83.2	402	395	390.0	395.7
C.D. (P=0.05)				4.1				1.7				22.6

Table 2 : Performance of different varieties on number of grains per ear and 1000 grain weight

Variety	Number of grains/ear				1000-grain wt (g)			
	2014-15	2015-16	2016-17	Average	2014-15	2015-16	2016-17	Average
PBW 725	60.3	61.3	59.7	60.4	43.5	43.5	43.9	43.6
PBW 677	52.3	53.7	53.7	53.2	42.7	41.2	41.0	41.6
HD 3086	61.0	61.7	60.0	60.9	42.9	40.9	41.6	41.8
WH 1105	62.0	61.0	62.0	61.7	41.1	41.5	41.2	41.2
HD 2967	57.3	58.0	58.3	57.9	40.1	42.8	42.7	41.9
PBW 621	54.3	55.0	57.7	55.7	40.8	43.2	44.8	42.9
PBW 550	54.3	54.3	61.0	56.6	41.6	44.3	42.1	42.7
PBW 658	54.0	56.7	55.7	55.4	43.2	42.9	39.2	41.8
PBW 590	55.3	54.0	53.0	54.1	39.2	42.5	42.0	41.2
C.D. (P=0.05)				2.8				NS

NS=Non-significant

Table 3 : Performance of different varieties on grain and straw yield

Variety	Grain yield (q/acre)				Straw yield (q/acre)			
	2014-15	2015-16	2016-17	Average	2014-15	2015-16	2016-17	Average
PBW 725	51	50.75	51.5	51	78.5	81.75	79	79.75
PBW 677	49	47.5	49.75	48.75	90.75	87.5	87.25	88.5
HD 3086	52	51	51.5	51.5	76.5	73	73	74.25
WH 1105	50.5	49	53.75	51	73.25	71	72.25	72.25
HD 2967	46.5	45.5	46.5	46.25	78	76.5	77	77.25
PBW 621	49.0	47.5	50.5	49.0	79.75	83.25	80	81
PBW 550	49	47	48.75	48.25	70.5	76.5	73.25	73.5
PBW 658	47	49	48.75	48.25	68	65.5	66.75	66.75
PBW 590	44.5	44	41.5	43.25	69.75	68	68.25	68.5
C.D. (P=0.05)				2.2				3.2

Grain yield :

It major economical part of the wheat crop. From all timely sown varieties HD 3086 (51.5 q/ha) produced significantly higher grain yield, which was statistically at par with PBW 725 (51 q/ha) and WH 1105 (51 q/ha) as compared to lower grain yield recorded with PBW 677 (48.75 q/ha), HD 2967 (46.25 q/ha), PBW 621(49 q/ha) and PBW 550 (48.25 q/ha). Among late sown varieties PBW 658 produced comparatively more yield from PBW 590 variety (Table 3). The experimental site was slightly saline in nature, so these varieties are very suitable for the area as these were less affected due to salinity. Grain yield among these varieties were higher due higher number of effective tiller per unit area and due to large number of grains per ear.

Straw yield :

Now a day the wheat straw in Punjab is also very costly and equally valuable, as it is used as animal feed and lot of paper industries. The variety which has more number of tillers and plant height will be able to get good straw yield. PBW 677 variety recorded significantly higher straw yield (88.5 q/ha) as compared to PBW 725 (79.75 q/ha), HD 2967 (77.25 q/ha), PBW 621 (81 q/ha). Whereas, WH 1105, PBW 658, PBW 590 and HD 3086 had significantly lesser straw yield as compared to these varieties.

Conclusion :

Salinity is the major factors of restricting productivity of wheat crop in the district. Lot of water logged area are present in Sri Muktsar sahib district of Punjab, to avoid this problem development of such wheat varieties, which are high yielding and resistance to biotic and abiotic stresses must be included. HD 3086, WH 1105 and PBW 725 are the three timely sown varieties, which are best suitable for the area. Secondly these varieties are short duration varieties, so the climate change does not much effect the yield of these varieties. The farmers of the area are advised to go with these varieties.

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