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## International Journal of Advanced Multidisciplinary Research (IJAMR)

ISSN: 2393-8870

www.ijarm.com

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### Research Article

## Ridge sowing technique: A new crop establishment technique for wheat in rice-wheat cropping system of northern Punjab

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### Abstract

#### Keywords

Ridge sowing,  
wheat crop,  
Agro Ecological  
conditions,  
sowing techniques

A field experiment was conducted to determine the best planting technique to resolve the problem of first and last irrigation applications to wheat crop during Rabi 2009-10 to 2011-12. Three sowing techniques *i.e.* broadcasting, drill sowing and ridge sowing were tested in Agro Ecological conditions of Adaptive Research Farm Gujranwala. Results of three years study revealed that maximum germination count was recorded wheat crop sown by Rabi drill (230.67, 281.33 and 260.67) compared to other sowing techniques. However, productive tillers/m<sup>2</sup> (349, 368 and 351.67) and 1000 grain weight (38.90, 40.37 and 39.96 g) were recorded maximum in crop sown on Ridges. Similarly maximum wheat yield (4.11, 3.81 and 3.92 t ha<sup>-1</sup>) was recorded during three years when crop was sown on Ridges. It is concluded that Ridge sowing technique was helpful to increase the yield of wheat in clayey soils of heavy rainfall areas.

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### Introduction

Wheat (*Triticum aestivum*) is the most important widely grown cereal crop in Pakistan due to many properties and uses of its grains and straw. Increment in grain yield of wheat is an important national goal to meet the continuous increasing food's need. In Pakistan wheat is grown on an area of 9039 thousand hectares having production 25.3 million tones (GOP, 2014). Rice wheat cropping system covers an area of 2.2 mha in Pakistan (Singh *et al.*, 2007; Mann *et al.*, 2008). It is a bread basket of the country (Ernestine, 2002). Wheat is sown on an area of 1051 thousand hectares in Gujranwala division (Anonymous, 2013). However, the soil of Gujranwala is mostly clayey in nature with poor drainage capacity. As heavy rains recorded (Fig. 1) during wheat season and water remains standing in the fields, which results in stunted growth of crop and ultimately loss in yield. Sowing technique is one of the important factors which may affect the germination and tillering become main hurdle for getting maximum yield (Kabesh *et al.*, 2009). Moreover, sowing method has a

significant effect on water, energy savings and soil compaction (Treadson *et al.*, 1989). Absorption of photo-synthetically active radiations is influenced by planting methods (Lal *et al.*, 1991). Dawelbeit and Babiker (1997) have also reported maximum yield for seed drilling and ridging than broadcasting. Bulk density or dense surface soil layer is a limiting factor for root growth, resulting in shorter root length and concentrate the roots near soil surface. Thus plants are forced to extract water and nutrients from limited soil volume (Chassot and Richner, 2002). Ridges provide loose fertile layer of soil that results well developed root system (Ao, *et al.*, 2010; Bucher, 2007). In Pakistan, wheat is sown through broadcasting on a large area after rice harvesting. Different planting methods have varying response under different experimental conditions (Khan *et al.*, 2007). Therefore evaluation of improved planting techniques is critical for subsequent recommendation. Thus present study have been planned to determine the best sowing technique of wheat to overcome this problem.

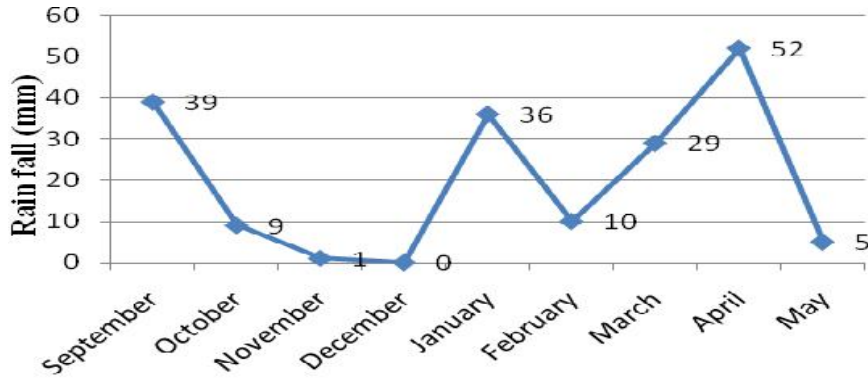


Fig. 1. Rain fall during crop season in Gujranwala

## Materials and Methods

A field experiment was conducted to determine the best planting technique to resolve the problem of first and last irrigation applications to wheat crop during Rabi 2009-10 to 2011-12. Three sowing techniques *i.e* broadcasting, drill sowing and ridge sowing were tested in Agro Ecological conditions of Adaptive Research Farm, Gujranwala. The experiment was designed according to Randomized Complete Block Design with three replications. Wheat variety Faisalabad-2008 was sown by using seed rate 125 Kg ha<sup>-1</sup>. In drill sowing 22.5cm R x R distance was maintained while in ridge sowing, firstly wheat was broadcasted in well prepared soil and then ridges were made by using Potato Ridger Agriculture Equipment. All recommended agronomic practices were uniformly applied to all of the experimental units. Observations were recorded for germination count/m<sup>2</sup>, productive tillers/m<sup>2</sup>, 1000 grain weight and grain yield. Standard procedures were adopted for recording the data of agronomic and yield related parameters. The data were statistically analyzed using analysis of variance appropriate for Randomized Complete

Block design. Means were compared by using LSD test at 0.05 level of probability when the F-value was significant (Steel, et. al., 1997).

## Results and Discussion

### Germination Count/m<sup>2</sup>

Data regarding germination of wheat depicted significant difference at  $p < 0.05$  among three sowing techniques as shown in Fig. 2. Maximum germination *i.e* 230.67, 281.33 and 260.67 was recorded for three years respectively when wheat crop was sown by Rabi drill. Whereas ridge sowing technique depicted minimum germination m<sup>-2</sup> *i.e*. 203.33, 243.33 and 210 during three years respectively compared to other techniques. Poor wheat emergence might be due to deep placement of seed at uneven depths (Ali et. al., 2012). On the other hand poor wheat emergence in broadcasting as compared to drill sowing was reported by Shaalan *et al.* (1997) and Tanveer *et al.* (2003). Collins and Fowler (1992) reported that there was a huge problem of germination in broadcasting of wheat in flat sowing techniques.

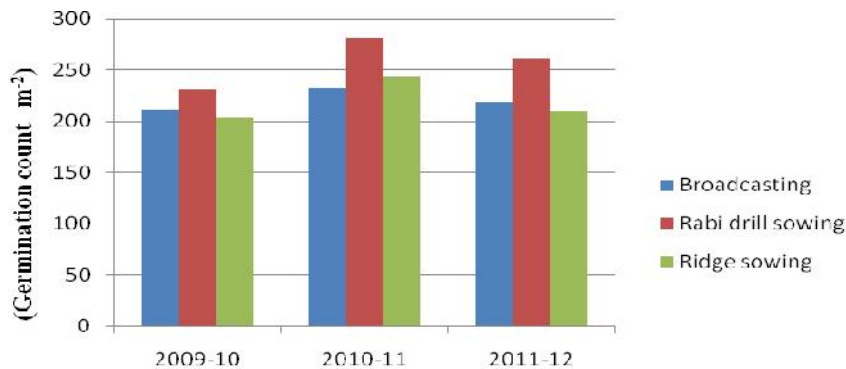
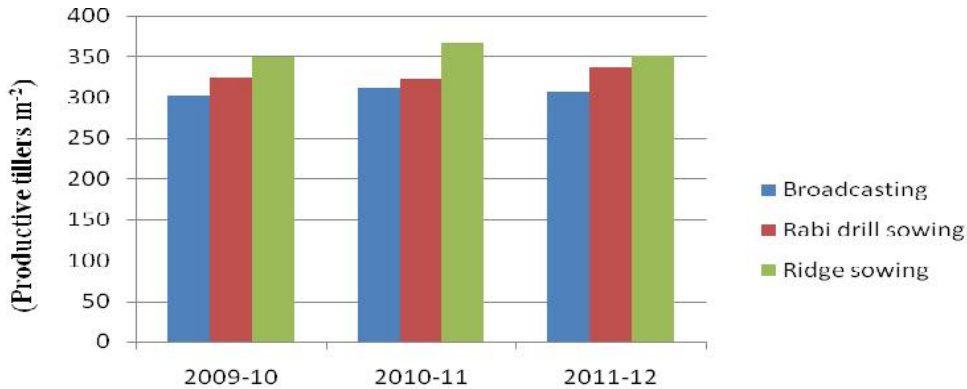


Fig 2. Germination count effected by sowing techniques

**Productive tillers/m<sup>2</sup>**

Analysis of data regarding productive tillers obtained from the wheat crop sown by different methods revealed significant difference ( $p < 0.05$ ) as shown in Fig. 3. Ridge sowing produced maximum number of tillers/m<sup>2</sup> (349, 368 and 351.67) and it was followed by drill sowing (324.33, 323.33 and 337). The minimum number of tillers was recorded in broadcasting technique (302, 311.67 and 308) during three years respectively. These results were in

accordance to Kabesh *et al.* (2009) who reported that increase in number of tillers/ m<sup>2</sup> of wheat crop recorded by ridge sowing technique. However better wheat tillering capacity was recorded by ridge sown compared to flat sowing technique. This was only due to better micro environment availability (Ao, et. al., 2010). Ridges provide loose fertile layer of soil resulting well developed root system and better tillering capacity of the crop (Ao, et. al., 2010; Bucher, 2007).

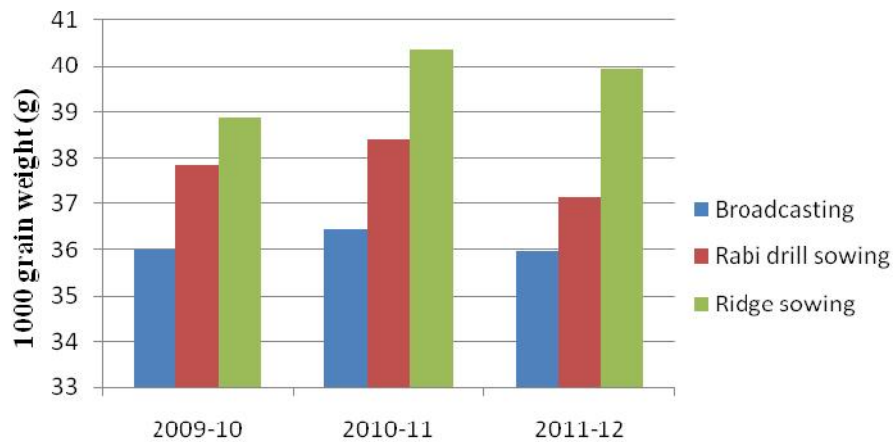


**Fig 3. Productive tillers effected by sowing techniques**

**1000 grain weight (g)**

1000 grain weight of wheat crop sown by different sowing methods (Fig. 4) differed significantly from each other. Data exhibited that ridge sowing technique gave maximum weight (38.90, 40.37 and 39.96 g) during three years respectively compared to other two techniques. However wheat crop sown by broadcasting method yielded minimum grain weight (36, 36.45 and 35.97 g) during three years respectively. These results are in line with previously illustrated results of Hassan and Hassan (1994) and Tanveer

*et al* (2003) who reported minimum 1000-grains weight was recorded by broadcasting technique compared to other planting methods. Kabesh *et al.* (2009) also reported increase in grain weight of wheat was recorded by ridge sowing method. This might be due to the proper aeration of roots which enhanced nutrient absorption capacity and ultimately got maximum yield (Bakht *et. al.*, 2011). Sowing of wheat by broadcasting method recorded reduction in yield contributing parameters which might be due to the fact that by this method increased competition between the neighboring plants (Ali, et. al., 2012).

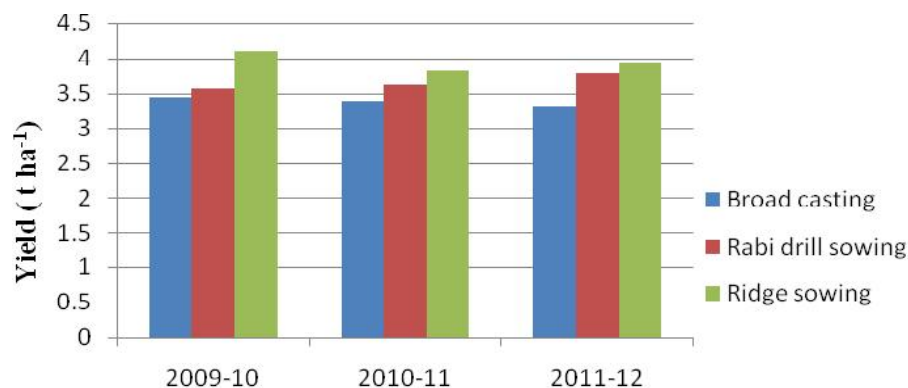


**Fig 4. 1000 grain weight effected by sowing techniques**

**Yield (t/ha)**

It is evident from the results that ridge sown wheat produce significantly better yield than wheat sown by Rabi drill and broadcasting method (Fig. 5). However, the data of yield of wheat crop recorded in drill sowing and broadcasting techniques were at par. Maximum number of productive tillers and 1000 grain weight contributed towards maximum grain yield in case of ridge sown wheat (4.11, 3.81 and 3.92 t ha<sup>-1</sup>) followed by drill sowing (3.57, 3.62 and 3.79 t ha<sup>-1</sup>) and broadcasting method (3.44, 3.39 and 3.32 t ha<sup>-1</sup>) for

three years respectively. Kabesh *et al.* (2009) reported increase in grain yield was recorded by the crop sown with ridge sowing technique. This might be due to the fact that ridge planting provided good soil conditions for proper root development, reduced lodging, ensured efficient use of irrigation water and nutrients for proper growth and development (Bakht *et al.*, 2011). Moreover, well developed root system improved water and nutrients uptake particularly Phosphorus (Chassot and Richner, 2002). Therefore, better crop stand establishment on raised beds or ridges might be resulted in higher grain yield in comparison with other planting techniques (Ali, *et al.*, 2012).



**Fig 5. Yield effected by sowing techniques**

**Economic Analysis**

Economic analysis computed on the basis of grain yield revealed that wheat crop sown on ridges gave higher gross (Rs. 106856 ha<sup>-1</sup>) and net income (Rs. 57988 ha<sup>-1</sup>) followed by drill sowing (Table 1). However cost of cultivation (Rs. 49103 ha<sup>-1</sup>) in crop sown by drill sowing was more than

ridge and broadcasting techniques. Benefit cost ratio in ridge sowing method was higher (2.19) than drill sowing (2.02) and broadcasting (1.97) techniques. Incremental benefit (Rs. 12781ha<sup>-1</sup>) and benefit cost ratio (5.17) was higher in ridge sowing than drill sowing techniques (Table 2). This high benefit cost ratio of ridge sowing may be due to high yield and less cost of production than drill sowing.

Table 1. Economic comparison of different sowing techniques

Treatments	Cost of cultivation (Rsha <sup>-1</sup> )	Gross Return (Rsha <sup>-1</sup> )	Net Return (Rsha <sup>-1</sup> )	B:C Ratio
Broadcasting	46397	91604	45207	1.97
Rabi drill sowing	49103	99095	49992	2.02
Ridge sowing	48868	106856	57988	2.19

Table 2. Incremental cost and benefits of drill and ridge sown wheat crop in comparison to Broadcasting

Treatments	Incremental Cost (Rsha <sup>-1</sup> )	Incremental Benefit (Rsha <sup>-1</sup> )	B: C Ratio
Rabi Drill Sowing	2706	4785	1.77
Ridge Sowing	2471	12781	5.17

## Conclusion

At the end it was concluded that Ridge sowing technique provided better solution to resolve the problem of application of first and last irrigation to wheat crop in rice zone and it produced a significant effect on growth and ultimately gave maximum yield. So it is recommended that farmers should adopt ridge sowing technique especially in clayey soils of heavy rain fall areas to increase the yield of wheat upto  $0.67 \text{ tha}^{-1}$ .

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