Performances of seed cum fertilizer drill for wheat crop in tribal area of Madhya Pradesh

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(Received: March 05, 2015; Revised received: September 16, 2015; Accepted: September 18, 2015)

Abstract: A field experiment was conducted during rabi seasons of 2011-12 and 2012–13 to assess seed-cum-fertilizer drill and simple seeddrill for sowing of wheat crop. Wheat sown by seed-cum-fertilizer drill was found higher in term of plant population, plant height, root length, grain weight per plant, seed yield, straw yield and economics of treatments comparison with simple seed drill sowing machine. The net return is the best index of profitability of wheat crop production and higher net return (Rs 42121 per ha) was recorded under seed cum fertilizer drill where as lowest net return of (Rs 30788 per ha) under normal seeddrill sowing

Key Words: Wheat, Seed-cum-fertilizer drill, Growth character, Yield

Introduction

Wheat (Triticum aestivum L.) is the most widely cultivated cereal crop of the world. The world would require around 840 million tonnes of wheat by 2050 from current production level of 642 million tonnes and it has to be achieved with less land and resources through genetic, physiological and agronomic interventions particularly resource conservation technologies (Sharma et al., 2015). In India, it is the second major food crop after paddy. The current production of wheat in India is approximately 74 million tonnes out of which about 91 percent is produced in six states viz. Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan and Bihar (Mishra, 2007). Crop sowing refers to placement of seeds in the soil under optimum condition and as per required seed rate. Line sowing is the most efficient means of sowing the crops and most ideal for crop management (Devnani, 1989). It facilitates manual and mechanical weeding between rows, optimum plant population, even with reduced seed rate, lower and more efficient seed rate than broadcasting. Row seeding also promotes maximum tillering and better sunlight penetration. Though the best placement depends upon the kind of crop, the nature of soil, the type of fertilizer salt and the climatic conditions, it has been conclusively proved that placing any kind of fertilizer in a band 30-50 mm to the side and 20-30 mm deep to the seed is safe and effective for most of the crops (Martin and Leonard, 1976 and Kepner et al., 1987). Verma and Dewangan (2007) conducted the study on design parameters on various seed, soil and machine component of a animal drawn seed cum fertilizer drill machine and revealed that germination of paddy, wheat, gram, soybean and linseed was not affected by the gravity flow orifice type metering mechanism. Khatri et al. (2002) reported that growth parameters such as number of tillers m⁻¹ row length, leaf area index, crop growth rate and dry matter accumulation, as well as yield attributes such as number of grains earhead¹, grain yield earhead¹ and test weight were higher with sowing in raised beds as compared to flat beds in wheat. Shukla (1987), Shrivastava (2005) and Choudhary (2002) reported that the performance of strip, zero and conventional till system for wheat cropping gave better results in the light soil. Kumar et al. (2002) observed raised bed system for seeding of wheat crop over existing method was undertaken to optimize furrow and bed dimensions with respect to crop parameters and concluded that higher grain and straw yields were recorded in flat system (36.42 q/ha and 63.82 q/ha) as compared to bed planter (34.79 q/ha and 58.40 q/ha). In bed planting there was considerable reduction in weed population before and after chemical control and there was 41.5% saving in irrigation water and 25.41% reduction in cost of operation. Tripathi and Chauhan (2000) conducted a experiment to optimize the fertilizer and seed requirements under different tillage conditions in wheat and concluded that zero tillage recorded maximum wheat yield (4.70 tonnes/ha in first and 4.86 tonnes/ha in second experiment) compared with the yield obtained under conventional tillage (4.12 tonnes/ha in first and 4.59 tonnes/ha in second experiment). Patro et al. (2014) was conducted experiment on four sowing methods (conventional sowing, seed-cum-fertilizer drill sowing, paired row sowing and criss-cross sowing) on groundnut production and concluded that paired row sowing gave significantly highest pod yield and net returns (1781 kg ha⁻¹ and Rs 19730 ha⁻¹).
respectively). Paired row sowing also improved various yield associated attributes viz., number of pegs (35.1) and pod plant \(^1\) (27.6), shelling percentage (66.6) and 100-kernel weight (33.6 g), and profitability (Rs 19,730) in groundnut. Jat and Singh (2003) reported higher biological yield and highest net and gross return from land configuration treatment as compared to conventional system has been reported. Shrivastav and Jha (2011) concluded that average yield by tractor till plant machine was 26.96 q/ha, whereas, by conventional practices and tractor drawn zero till drill was 25.91 and 22.72 q/ha respectively. Mandal et al. (2014) concluded that technology of zero tillage method of growing wheat has been found in West Bengal to save the total cost over conventional system by above Rs. 7500 ha\(^{-1}\) for sowing of Wheat. Rawat et al. (2007) concluded that the zero till ferti seed drill was found energy efficient and cost efficient compared to conventional sowing of wheat on the basis of energy ratio, specific energy and benefit cost ratio. The study has revealed that it is possible to save machine labour and irrigation water under zero tillage than under conventional method an due to resource saving, net return has been significantly higher in zero tillage technology (Tripathi et al., 2013). Chaudhary et al. (2002) study on zero, strip and conventional till systems to compare their performance of sowing wheat and the results indicated that the saving in irrigation for zero till was 34 and 47% over strip till and conventional systems and grain yields were 3627, 3637 and 3488 kg/ha for zero, strip and conventional till systems, respectively. Muhammad et al. (2013) concluded from the results that tillage implements followed by rotavator showed better performance in terms of number of tillers and harvest index of wheat than sole use of line cultivator twice and sowing by drill produced better results in terms of emergence, number of tillers, spike length and harvest index as compared to broadcasting. Sharma et al. (1984) reported that on an average increase in grain yield of wheat and gram was 24.92 per cent and 20 percent respectively with the use of seed drill over traditional method. A study was conducted to evaluate the effect of use of the mechanical sowing on wheat yield in comparison with traditional methods and animal drawn mechanical sowing has resulted in a 10.4 per cent increase in yield. (Sharma et al., 1989). Dixit et al. (2004) concluded that no-till seed cum fertilizer drill has resulted in 17.09% increase in yield ,83.22% saving in energy and 80.34% saving in cost of production over conventional seed drill. The basic objective of sowing operation is to put the seed and fertilizer in rows at desired depth and seed to seed spacing, cover the seeds with soil and provide proper compaction over the seed. The recommended row to row spacing, seed rate, seed to seed spacing and depth of seed placement vary from crop to crop and for different agro-climatic conditions to achieve optimum yields through the proper placement of fertilizers in relation to seeds or plant roots is important for efficient utilization of nutrients. Application of fertilizers directly above or below the seed is not much effective as fertilizer so placed may move into the seed zone with movement of water that takes place mostly in vertical direction. With a view to generate information, a field experiment was conducted at farmer’s fields to observe effect of seed-cum-fertilizer drill sowing machine on the growth characters and yield of wheat.

### Materials and Methods

The field experiments were conducted at the farmer’s fields during rabi 2011-12 and 2012-13 in the village Bagad and Bhubarkheda in Dhar district of Madhya Pradesh with five replications to assess the effect of seed cum fertilizer drill machine on growth characters and yield of wheat crop. Seed-cum-fertilizer drill sowing machine was used for sowing of wheat crop in experimental plot and conventional seeddrill was used for sowing of wheat under farmers practice. Seed cum fertilizer drill is a machine that places seeds and fertilizer in separate bands at specified rates in rows at proper depth and covers the with soil. The seed cum fertilizer drill consists of a seed box, fertilizer box, seed and fertilizer metering mechanisms, seed tubes, furrow openers, seed and fertilizer rate adjusting lever and transport cum power transmitting wheel. Sowing of wheat was done at the seed rate of 100 kg/ha. The fertilizers were applied before sowing as per the treatments. The row to row distance of 22.5 cm was maintained for obtaining the desired plant population. The quantity of fertilizers applied as per 100 % RDF (100:60:40 kg N: P\(_2\)O\(_5\): K\(_2\)O per ha), Nimje et al. (2002) and Dhakad and Khedkar (2014) reported that effect of seed-cum-fertilizer drill sowing machine for soybean crop.

The machine parameters (Time required in sowing, diesel consumption, field capacity of implement, require labour and cost of operation during sowing) were measured from seed-cum-fertilizer drill and seeddrill sowing machine. The observations like plant population, plant height, root length, days to germination and days to 50% flowering, days to 75 % maturity, grain weight per plant and seed index were recorded from five plants randomly selected from each treatment from each replication. Besides these, seed yield, straw yield, harvest index and economics of treatments were also calculated for continuously two years 2011-12 and 2012-13. The data collected on various characters of wheat crop was processed and subjected to statistical analysis by t test as suggested by William Sealy Gosset (Fisher Box, Joan 1987). First, all the growth and yield attributes of wheat crop was analyzed and then the results were pooled over for both the years and analyzed. The experiment comprising two treatments with five replications and in this case the number of plots was 02 x 05 = 10 and degree of freedom was 8 \(\{5-1\} + \{5-1\}\). Statistical analysis was carried out by analyze the difference between two treatments using the ‘t’ test of significance and the formula for T test is given below

\[
T = \frac{x_1 - x_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}
\]

Where, \(x_1\) = Mean of first set of values, \(x_2\) = Mean of second set of values, \(S_1\) = Standard deviation of first set of values, \(S_2\) = Standard deviation of second set of values, \(n_1\) = Total number of values in first set, \(n_2\) = Total number of values in second set.

Finally, the calculated ‘t’ value is compared with the theoretical value from a ‘t’ table at 5% probability level. Based on the comparison of calculated ‘t’ value with the theoretical ‘t’ value from the table, we conclude: If the calculated “t” value is greater than the theoretical ‘t’ value, then the difference between the two
treatments is significant. If the calculated 't' value is less than the theoretical 't' value, then the difference between the two treatments is not significant.

Result and Discussion

The pooled data related to sowing machine performances, crop growth and yield are presented in Table-1. Comparative performance of seed cum fertilizer drill and normal seeddrill for wheat crop parameters indicates that the parameters (time required in sowing, diesel consumption, field capacity of implement, require labour and cost of operation during sowing) showed non-significant differences due to different sowing machines. The plant population 13.75 % higher on seed cum fertilizer drill machine sowing as compared to normal seed drill. This indirectly indicated that use of seed cum fertilizer drill machine promotes better germination and emergence of the crop as compared to normal seed drill. Plant height was recorded in significantly higher in seed cum fertilizer drill in the pooled data analysis. For root studies, observation on root length was recorded and analysed statistically through the t test. Root characters of wheat crop was significantly higher in seed cum fertilizer drill sowing as compared to normal seed drill sowing in which root length was 8.9 % more in seed cum fertilizer drill due to better placement of fertilizer. Physiological parameters (days to germination, days to 50 % flowering and days to 75 % maturity) showed non-significant differences due to different sowing machines.

The grain weight per plant, grain yield, straw yield and net monetary returns were statistically higher in seed cum fertilizer drill sowing compare to normal seeddrill sowing. The analysis showed that there was no significant difference on seed index, grain straw ratio and harvest index due to treatments was observed. The highest productivity of 3958 kg/ha^2 observed in the seed cum fertilizer drill sowing where as lowest under normal seeddrill sowing (3353 kg ha^-1) in pooled data. The net return is the best index of profitability of wheat crop production and higher net return (Rs 42121 per ha) was recorded under seed cum fertilizer drill whereas lowest net return of (Rs 30788 per ha) was recorded under normal seeddrill sowing.

Singh and Singh (1981) observed an increase of 17.3 per cent in wheat yield using the Malviya seed-cum-fertilizer drill at the farmer’s fields. Nimje et al (2002) also reported an increase in planting densities and net income of soybean due to seed-cum-fertilizer drill and strip-till seed-cum-fertilizer drill machine in Vertisol. Dhakad and Khedkar (2014) reported that effect of seed-cum-fertilizer drill sowing machine for soybean crop at farmer’s fields and concluded that soybean sown by seed-cum-fertilizer drill was found better in term of growth character (plant population, plant height, number of branches per plant and number of root nodules per plant) and seed yield weight per plant, seed yield and straw yield comparison with simple seed drill sowing machine.

Effect of seed-cum-fertilizer drill sowing on the growth characters of wheat and yield was found better in comparison with normal seeddrill sowing. Seed-cum-fertilizer drill sowing recorded net return significantly higher over the normal seeddrill sowing for wheat crop. The results of experiment indicate that for achieving higher productivity of wheat crop in tribal area under Dhar district of Madhya Pradesh, the wheat crop should be sown by seed-cum-fertilizer drill sowing machine.

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