# Performance Evaluation of Zero-Till Ferti-Seed Drill in Comparison to Conventional and Reduced Tillage Methods of Wheat Crop on the Same Day

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***Abstract***- Rice–wheat cropping system is very common in India. It contributes to over 70% of total food grain production in the country with an area of 12 M ha under this cropping system. However, it is estimated that under rice and wheat crops separately the area is 42.31 and 22.98 M ha respectively. Looking to the above facts a study at farmer's field of Ambedkar Nagar district was under taken to evaluate the performance of zero-till seed cum ferti-drill along with other system of wheat seeding. The zero-tillage technique may be adopted successfully for seeding to grow wheat after rice by using zero-till ferti seed-drill (ZTFDS) developed at GBPUA&T, Pantnagar and now manufactured commercial. Although this method of wheat seeding using zero-till seed cum ferti drill is becoming very popular in Haryana and Punjab states but it is not popular in U. P. particularly in central Uttar Pradesh. The zero-tillage sowing was found to be most time saving (88%) and energy efficient (79%) as compared to conventional method of sowing. Wheat crop can be sown 10-15 days early as compared to conventional method of sowing. This will result in timely sowing of wheat crop and increase in yield. In zero-till ferti seed-drill (T4) System the average cost of irrigation 2592.0 Rs/ha which was 667.5 Rs/ha lesser in comparison to conventional system and gives 21% saving. The zero-till ferti-seed drill work satisfactorily and gaves no trouble in the field while operating. It was observed that zero-till ferti seed-drill system was found an acceptable machine by the farmers of district Ambedkar Nagar (U. P.) because the zero-till ferti seed-drill system gives highest benefit cost ratio (1.76) in comparison to conventional system.

***Index Terms***- Wheat, economic, tillage, zero-till seed-drill and sowing time

## I. INTRODUCTION

Rice–wheat cropping system is very common in India. It contributes to over 70% of total food grain production in the country with an area of 12 M ha under this cropping system. However, it is estimated that under rice and wheat crop separately, the area is 42.31 and 22.98 M ha respectively. This cropping system is also most predominating in Utter Pradesh, which occupies 65% of total cultivated area. Further wheat is most important crop of Utter Pradesh which alone about 35.5% of total area under this crop grown in country and producing more than one third of the total wheat. Thus, it is necessary that production of rice and wheat must keep pace with the growing population of our country. However, the factors such as degradation in natural resource shift in cropping pattern and energy constraints etc. are causing reduction in the productivity of these crops. In irrigated rice-wheat system; rice is mostly transplanted in puddle field. This causes delay in sowing which result in reduced crop yield to 30-40 kg per ha per day if crop is sown after 13$^{th}$ Nov. [2]. Delayed sowing of wheat is also due to late harvesting of rice, soil wetness, poor rice residue management, multiplicity of tillage operation, and non-availability of power source and arrival of rain in the month of November [1, 5]. Therefore, the late sowing situation of wheat in rice-wheat cropping system to be very critical where about 80% of the areas under wheat are sown late after harvesting of rice resulting into reduces productivity. This loss can be saved through early seeding of wheat by no-tillage technique. This technique advanced operation by 10-15 days and also reduces the cost of production by saving energy [3,4]. The zero-tillage technique may be adopted successfully for seeding to grow wheat after rice by using zero-till ferti seed-drill (ZTFDS) developed at GBPUA&T, Pantnagar and now manufactured commercial. Although this method of wheat seeding using zero-till seed cum ferti drill is becoming very popular in Haryana and Punjab states but it not popular in U. P. particularly in central Uttar Pradesh.

## II. MATERIALS AND METHODS

The description of tools and equipments used and methodology adopted for field evaluation and testing of zero-till ferti seed-drill in comparison to conventional and reduced tillage for rising of wheat crop.

### Calibration of seed-drill

The seed-drill was calibrated for wheat sowing using the metering mechanism. The seed-drill was placed on a level

ground and jacked up to facilitate the rotation of ground drive wheel freely. Laboratory test was carried out for ten revolution of ground drive wheel for different exposure length to determine seed rate. The seed rate/ha was determined for each exposure length of fluted rollers. The following equation was used to determine the seed rate.

$$W = \frac{q \times 10^5 (1-S/100)}{\pi D n d}$$

Where,

W = Seed rate, kg/ha

Q = Quantity of seed dropped from all furrow openers per revolution of ground drive wheel, g

N = Number of furrow openers

d = Distance between two successive openers, cm

S = Slip, (%)

D = Diameter of ground drive wheel, cm

**Determination of test weight**

The test weight was determined in laboratory by counting by 1000 grains of wheat seed and weighting then on electronic balance.

**Experimental details**

The performance evaluation of drill was conducted in an area of 7.2 acres at seven farmer's field of district, Ambedkar Nagar in the month of November. The zero-till ferti seed-drill was evaluated in comparison to different tillage and seeding systems for raising wheat crop during the rabi season of over an area of 0.4 ha at farmer farm, Ambedkar Nagar. The previous crop sown in the testing plot was paddy. The harvesting of paddy crop was done manually. The average height of paddy stubbles was 5.03 cm and average moisture content and bulk density of soil was 17.25% and 1.40 g/cc respectively. The test field was divided into twelve equal plots of size 50 m × 6 m. The different treatments adopted for the study were as following:

| S.N. | Plot | Tillage and deeding operation |
|---|---|---|
| 1. | $T_1$ | Disc harrowing × 2 + cultivating with planking × 1 + planking × 1 + seeding by seed-cum ferti-drill |
| 2. | $T_2$ | Disc harrowing × 1 + cultivating with planking × 1 + planking × 1 + seeding by seed-cum ferti-drill |
| 3. | $T_3$ | Power tiller rota tilling × 1 + Tractor planking × 2 + seeding by tractor drawn seed-cum ferti-drill |
| 4. | $T_4$ | Zero-till ferti seed-dril |

Design: R.B.D. Plot size- 50m × 6 m

**Filed preparation**

Field preparation under conventional tillage and seeding system ($T_1$) was done by harrowing twice using twelve disc trailed type off set disc harrow operated by 35 hp tractor followed by single cultivating using nine tyne spring loaded cultivator with planker operated by 35 hp tractor followed by one planking using tractor drawn planker of two meter size. After the field preparation, wheat seeding was done by tractor having 11 row seed cum ferti drill. In reduced tillage system ($T_2$) field preparation was done by single harrowing following by single cultivating with nine tyne cultivator with planker followed by one planking using the tractor drawn planker. After the field preparation, wheat seeding was done by tractor drawn 11 row seed cum ferti drill. In minimum tillage system ($T_3$) field preparation was done by single rota tilling using 8 hp power tiller rotavator followed by twice planking using tractor. Wheat seeding was done by tractor drawn 11 row seed cum ferti drill. In zero-till system ($T_4$) wheat seeding was done by inputs like fertilizers, irrigation were used in same quantity as per recommended package of practice for wheat crop production.

## III. RESULTS AND DISCUSION

The test results are given in the Table 2: Data showed that maximum deviation from average weight of seed per furrow opener was 6.7% where as in case of fertilizer (Urea + DAP missed in the ratio of 1:1.64) was 3%. The deviation of average value from recommended rate was – 2.42% for seed and -0.26% for fertilizer. The results showed that seed and fertilizer distribution were within the recommended limit of BIS test code IS 6316 for seed cum fertilizer drill.

***Table 2: Results of laboratory test of 11- row zero-till seed ferti-drill Seed and fertilizer distribution test (Revolution of ground drive wheel 10)***

| S.N. | Furrow opener | Seed | Fertilizers (1:1.64) | Rate setting, kg/ha | | Row Spacing, cm | Wt. of Dropped/ Furrow opener, g | Wt. of fertilizers Dropped/ Furrow Opener, g |
|---|---|---|---|---|---|---|---|---|
| | | | | Seed | Fertilizers | | | |
| 1. | 1. | Wheat | Urea +DAP | 100 | 210 | 18.5 | 25.0 | 55.0 |
| 2. | 2. | Wheat | Urea +DAP | 100 | 210 | 18.5 | 26.5 | 57.5 |
| 3. | 3. | Wheat | Urea +DAP | 100 | 210 | 18.5 | 26.0 | 58.0 |
| 4. | 4. | Wheat | Urea +DAP | 100 | 210 | 18.5 | 23.0 | 56.0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5. | 5. | Wheat | Urea +DAP | 100 | 210 | 18.5 | 28.0 | 56.0 |
| 6. | 6. | Wheat | Urea +DAP | 100 | 210 | 18.5 | 26.0 | 55.0 |
| 7. | 7. | Wheat | Urea +DAP | 100 | 210 | 18.5 | 27.0 | 56.5 |
| 8. | 8. | Wheat | Urea +DAP | 100 | 210 | 18.5 | 27.0 | 57.0 |
| 9. | 9. | Wheat | Urea +DAP | 100 | 210 | 18.5 | 27.5 | 55.5 |
| 10. | 10. | Wheat | Urea +DAP | 100 | 210 | 18.5 | 27.0 | 5.0 |
| 11. | 11. | Wheat | Urea +DAP | 100 | 210 | 18.5 | 26.5 | 57.5 |
| 12. | Average | | | | | | 26.32 | 56.36 |
| 13. | Maximum deviation from average, % | | | | | | 6.7 | 3.0 |
| 14. | Deviations of average from recommended rate, % | | | | | | -2.42 | -0.26 |

***Table 3: Average observations of wheat crop growth parameters and yield under different tillage and seeding systems***

| **Parameters** | **Treatments** | | | |
|---|---|---|---|---|
| | **$T_1$** | **$T_2$** | **$T_3$** | **$T_4$** |
| Germination counts at 21 Days. | 160 | 148 | 168 | 160 |
| Plant population at Maturity, (no./plant) | 543.33 | 540.33 | 545.33 | 565 |
| Tillering, no./plant | 8.8 | 8.6 | 9.1 | 8.7 |
| Plant height, cm | 91.0 | 88.7 | 89.4 | 89.9 |
| Length of ear head, cm | 10.7 | 10.5 | 10.8 | 10.4 |
| No. of grains per ear head | 53.73 | 52.33 | 52.80 | 52.06 |
| Grain yield, q/ha | 40.30 | 39.60 | 40.40 | 40.20 |
| Straw yield, q/ha | 62.23 | 59.40 | 58.13 | 59.79 |

## IV. SUMMARY AND CONCLUSIONS

The performance of zero-till ferti seed-drill (ZTSFD) was evaluated in laboratory as well as in field condition after paddy harvesting at farmer's farm. The experimental plot soil was loamy having initial moisture content of 17.23% and bulk density 1.62g/cc. The following conclusions were drawn.

- Wheat crop can be sown10-15 days earlier as compared to conventional method of sowing. This will result in timely sowing of wheat crop and increase in yield.
- In zero-till ferti seed drill (T4) System, the average cost of irrigation was 2592.0 Rs/ha which was 667.5 Rs/ha lesser in comparison to conventional system and gives 21% saving.
- The zero tillage sowing was more economical (79%) in comparison to conventional methods of sowing.
- It was observed that zero-till ferti seed-drill system was found an acceptable machine by the farmers of district Ambedkar Nagar (U. P.) because the zero-till ferti seed-drill system gave highest benefit cost ratio (1.76) in comparison to conventional system.

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