www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; SP-12(11): 351-353

www.thepharmajournal.com
Received: 14-09-2023
Accepted: 18-10-2023

Sachin Gajendra
M.Tech, Farm Machinery and Power Engineering, JNKVV, Jabalpur, Madhya Pradesh, India

KB Tiwari
Associate Professor, Farm Machinery and Power Engineering, JNKVV, Jabalpur, Madhya Pradesh, India

Corresponding Author:
Sachin Gajendra
M.Tech, Farm Machinery and Power Engineering, JNKVV, Jabalpur, Madhya Pradesh, India

Assessment of the suitable length of straw for smooth sowing with seed drill after the different combinations of machinery used in harvested field

Sachin Gajendra and KB Tiwari

Abstract
Indian agriculture produces about 800 million tonnes of crop residues annually. The main purpose of straw management in harvested field through farm machinery is to reduce the burning of crop residues such as wheat stubble. This can have negative impacts on air quality, productivity of soil resources, loss of nutrients, pollution from smoke and increased carbon dioxide in the environment. The alternate methods to reduce the residue burning and management of large quantity of straw are use of farm machinery such as straw chopper, disc harrow, rotavator and happy seeder. The different combinations of these machinery were tested in the field. In this experiment, six treatments, i.e., T_1 (straw chopper), T_2 (disc harrow), T_3 (rotavator), T_4 (happy seeder), T_5 (straw chopper followed by disc harrow) and T_6 (disc harrow followed by rotavator) were taken with four replications for each treatment. The average straw height before the operation of all treatments was 30.2 cm and after the operation was 6.35, 8.28, 7.81, 7.04, 5.71 and 6.05 cm for treatments T_1, T_2, T_3, T_4, T_5 and T_6, respectively. The minimum straw height was measured in treatment T_5 and the maximum height was measured in treatment T_2.

Keywords: Suitable length, straw, smooth sowing, seed drill, machinery, harvested field

Introduction
Indian agriculture produces about 800 million tonnes of crop residues annually (Tanmay *et al*., 2023) [9]. Reduced tillage and stubble retention started 40 years ago, following development of the first knockdown of herbicides. These practices meant a change from conventional cultivation, which at stubble burning and several passes with tines or discs to control weeds and produce a seedbed (Cloutier *et al*., 2007) [2]. Reduced cultivation and retained stubble led to improved soil structure and less soil erosion and the environmental value of conservation cropping became more widely recognized (Holland *et al*., 2004) [4]. Many farmers adopted minimum tillage, which consisted of a single cultivation before sowing, generally with a tined implements (Johansen *et al*., 2012) [6].
Burning crop residues such as wheat stubble can have negative impacts on air quality, productivity of soil resources, loss of nutrients, pollution from smoke and carbon dioxide in the environment etc. (Kumar and Joshi, 2013) [7]. Alternatively, besides burning can be managed the large quantity of wheat straw after the harvesting, with the help of implements like straw chopper, disc harrow, rotavator, etc. (Bhattacharyya *et al*., 2021) [1]. These practice have long been used to aid the management of diseases and weeds and to enable the planting of next crop.
Large size of straw create problem at the seeding of subsequent crop (Donaldson *et al*., 2001). The common residue problems are difficulties and blockages in the seeders cause down time and poor establishment, Stubble height and volume can both impede the progress of growing seeds, Establishment in a dry season can be difficult where the straw doesn't break down, Sowing problems (blockage with tined machines). Large volumes of residue can lead to poor seed germination and weed control in crop due to interception of crop residue.
This assessment aims to manage the straw in combine harvested wheat crop field using different combinations of farm machines.

Material and Methods
Measurement of straw parameters
a. Moisture content of straw
The straw moisture analysis was done by oven drying method (Plate 1) (Jimenez and Ladha,

1993) [5]. Randomly straw samples were collected by selected field. The weight of the straw samples was measured by weighing balance. The straw sample was put in hot air oven at 70 °C for 4 days and then the weight of dry sample was measured. Moisture content of straw was measured on dry weight basis using following relation:

$$\text{Moisture content of straw } (\%\text{db}) = \frac{W_W - W_d}{W_d} \text{ X } 100 \quad \text{eq.1}$$

Where,
W_W = weight of wet straw (g).
W_d = weight of dry straw (g).

Plate 1: Measurement of moisture content of straw

b. Straw population
Initial straw population of wheat crop was calculated using a square frame of area 1x1 meter placed randomly in the field where the operation was performed (Xia *et al*., 2014) [10]. Seven samples were taken for each replication and then average value of straw population was calculated.1 m^2 area is shown in Plate 2.

Plate 2: Measurement of straw population

c. Straw height
The heights of straw were taken before the operation of implements and after the operation of implements in combine harvested wheat crop field (Sindhu *et al*., 2007) [8]. The heights of seven straws were taken randomly from each plot and average was taken. The height of straw was measured with the help of steel scale.

d. Weight of straw
The weight of the straw per square meter was taken from each plot with the help of weighing balance.

e. Straw uprooted efficiency
The straw uprooted efficiency is the ratio of straw uprooted and total number of straw in the selected plot. A square wire of frame area 1x1 m^2 placed randomly in the field for the experiment. The number of uprooted and total straw in the selected area was counted after the operation with different implements. The data of uprooted straw was taken from seven different places from the field and the average value was taken for the calculation.

Result and Discussion
Straw parameters
The average moisture content of straw was 13.2% (db). The average population of straw was 256 per square meter. The average straw weight per square meter was 425 g. The average straw height before the operation of all treatments i.e. T_1 (straw chopper), T_2 (disc harrow), T_3 (rotavator), T_4 (happy seeder, T_5 (straw chopper followed by disc harrow) and T_6 (disc harrow followed by rotavator) was 30.2 cm and the average straw height after the operation was 6.35, 8.28, 7.81, 7.04, 5.71 and 6.05 cm for treatments T_1, T_2, T_3, T_4, T_5 and T_6 respectively. The minimum straw height reduction was measured in treatment T_5 and the maximum height reduction was measured in treatment T_2. The average height reduction in percentage was 78.9, 72.5, 4.1, 76.8, 81.1 and 79.8% for treatment T_1, T_2, T_3, T_4, T_5 and T_6 respectively.

Straw uprooted efficiency for different treatments
The average uprooted straw and uprooted straw efficiency for different treatments (Fig.1). The average number of uprooted straw was 13, 154, 213, 95, 245, 184 and uprooted straw efficiency was 6.25, 60.15, 83.2, 37.1, 95.7 and 71.87% for treatments i.e. T_1 (straw chopper), T_2 (disc harrow), T_3 (rotavator), T_4 (happy seeder), T_5 (straw chopper followed by disc harrow) and T_6 (disc harrow followed by rotavator) respectively. The minimum straw uprooted efficiency was measured in treatment T_1 and the maximum straw uprooted efficiency was measured in treatment T_6.

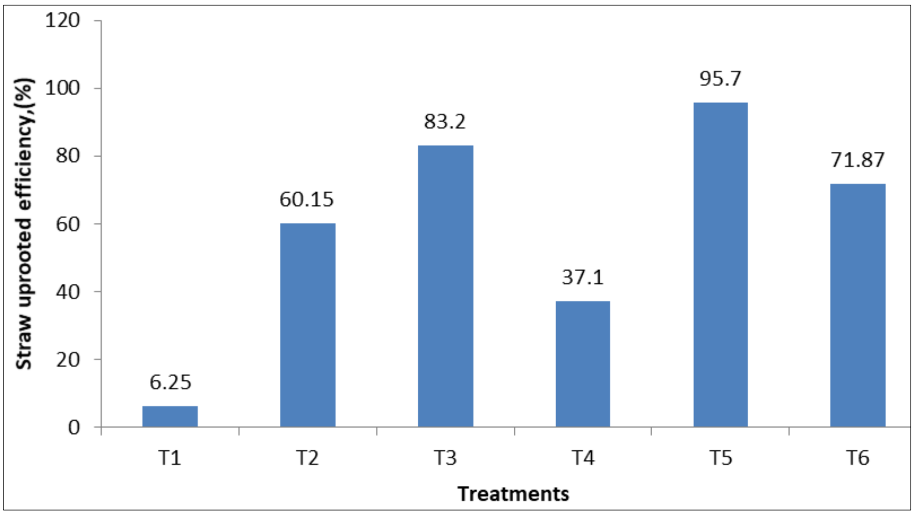

Fig 1: Straw uprooted efficiency for different treatments.

Conclusion

There was no hindrance observed during sowing with seed drill for a length of straw up to 6.05 cm. Straw height observed in treatment T_5 (straw chopper followed by disc harrow) and treatment T_6 (disc harrow followed by rotavator) was 5.71 and 6.05 respectively. Therefore, any of the treatments among T_5 and T_6 can be recommended for straw management.

Reference

1. Bhattacharyya P, Bisen J, Bhaduri D, Priyadarsini S, Munda S, Chakraborti M, *et al*. Turn the wheel from waste to wealth: economic and environmental gain of sustainable rice straw management practices over field burning in reference to India. Science of the Total Environment. 2021;775:145896.
2. Cloutier DC, Weide VDRY, Peruzzi A, Leblanc ML. Mechanical weed management. Nonchemical Weed Management: Principles, Concepts and Technology. CAB International, Wallingford, UK; c2007. p. 111-134.
3. Donaldson E, Schillinger WF, Dofing SM. Straw production and grain yield relationships in winter wheat. Crop Science. 2001;41(1):100-106.
4. Holland JM. The environmental consequences of adopting conservation tillage in Europe: reviewing the evidence. Agriculture, ecosystems & environment. 2004;103(1):1-25.
5. Jimenez RR, Ladha JK. Automated elemental analysis: A rapid and reliable but expensive measurement of total carbon and nitrogen in plant and soil samples. Communications in Soil Science and Plant Analysis. 1993;24(15-16):1897-1924.
6. Johansen C, Haque ME, Bell RW, Thierfelder C, Esdaile RJ. Conservation agriculture for small holder rainfed farming: Opportunities and constraints of new mechanized seeding systems. Field crops research. 2012;132:18-32.
7. Kumar P, Joshi L. Pollution caused by agricultural waste burning and possible alternate uses of crop stubble: a case study of Punjab. Knowledge systems of societies for adaptation and mitigation of impacts of climate change; c2013. p. 367-385.
8. Sidhu HS, Humphreys E, Dhillon SS, Blackwell J, Bector V. The Happy Seeder enables direct drilling of wheat into rice stubble. Australian Journal of Experimental Agriculture. 2007;47(7):844-854.
9. Tanmay J, Ahmed I, Debendra C. Assessment of bioenergy and syngas generation in India based on estimation of agricultural residues. Energy Reports. 2023;9:3771-3786.
10. Xia L, Wang S, Yan X. Effects of long-term straw incorporation on the net global warming potential and the net economic benefit in a rice–wheat cropping system in China. Agriculture, ecosystems & environment. 2014;197:118-127.