Short Communication

BIOMEDICAL Journal of Scientific & Technical Research

ISSN: 2574 -1241

DOI: 10.26717/BJSTR.2022.44.007054

Soil Weed Seed Bank Dynamics After Two-Year of On-Farm Trials Under Conservation Agriculture in Bangladesh

Mohammad Mobarak Hossain*, Mahfuza Begum and Moshiur Rahman

Department of Agronomy, Bangladesh Agricultural University, Bangladesh

***Corresponding author:** Mohammad Mobarak Hossain, Department of Agronomy, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

ARTICLE INFO

Received: May 02, 2022

Published: June 09, 2022

Citation: Mohammad Mobarak Hossain, Mahfuza Begum and Moshiur Rahman. Soil Weed Seed Bank Dynamics After Two-Year of On-Farm Trials Under Conservation Agriculture in Bangladesh. Biomed J Sci & Tech Res 44(3)-2022. BJSTR. MS.ID.007054.

ABSTRACT

Continuous practice of Conservation Agriculture showed that Strip Tillage decreased seed bank size by 22% by decreasing weed seeds by 24% at 0–5 cm and 57% at 10–15 cm depth but increasing by 25% at 5–10 cm depth. Two-year cropping with 50% residue preservation decreased the seed bank by 11%, with a declining trend in seed numbers from upper to lower soil layers. Weed growth can be hampered by residue, which can favor weed seed predation by soil fauna and decrease the weed seed bank. After a two-year analysis in no-residue practice, the seed bank remained stable. Based on these findings, Conservation Agriculture practice could result in a decrease in the soil weed seed bank.

Introduction

While Conservation Agriculture (CA) has been recognized as an excellent method for boosting crop yields sustainably, weed management is often regarded as one of the most difficult aspects [1]. Due to the reduced tillage operation, the composition and dynamics of the weed seed bank in CA will vary as compared to conventional tillage. The soil weed seed bank is a repository for weed seeds that influences the species composition. The seed bank is the primary source of weeds, represents a critical stage in the weed life cycle, and the weed population is inextricably linked to its seed bank. Knowledge of the size and composition of the soil weed seed bank is critical for forecasting future weed infestations and management techniques, weed seed production after the cropping season, calculation of crop-weed competition and crop yield loss, as well as agricultural economics [2]. There are relatively few research that investigate the influence of CA principles on the dynamics of weed seed banks. These sorts of research are necessary to include weed management into cost-benefit assessments of CA adoption. In light of this, long-term CA studies were done to determine the influence of CA principles on the dynamics of weed seed banks.

Materials and Methods

We conducted green-house experiments at the Department of Agronomy, Bangladesh Agricultural University in Mymensingh, Bangladesh. Soil was taken from the site of long-term CA experiments in the Durbacahra village of Gouripur upazila in Bangladesh's Mymensingh district. Under the Summer Rice–Mustard–Winter Rice cropping system, crops were cultivated using conventional tillage (CT) and strip tillage (ST), with 50% standing residues from previous harvests retained compared to no-residue. CT was performed using a two-wheeler tractor, whereas ST was performed using a Versatile Multi-Crop Planter machine [3]. Prior to the trials, five soil samples from each plot were obtained at depths of 0–5 cm, 5–10 cm, and 10–15 cm in a "W" pattern [4]. One

kilogram of dirt from each plot was deposited in a 32 cm diameter plastic dish. To ensure adequate weed germination, the samples were maintained wet. During a one-year period, emerging seedlings were recognized, numbered, and destroyed at 30-day intervals. To help identification, seedlings of dubious identity were transplanted to another plate and nurtured to maturity. Following the removal of each batch of seedlings, the soils were carefully mixed and re-wetted to allow for further emergence. This procedure was done a total of 12 times. The seedlings that were counted were translated to numbers per m^2. Following the conclusion of the two-year field experiments in Gouripur, soil samples were gathered again using a similar approach, and the same experimental procedures were used in the green house.

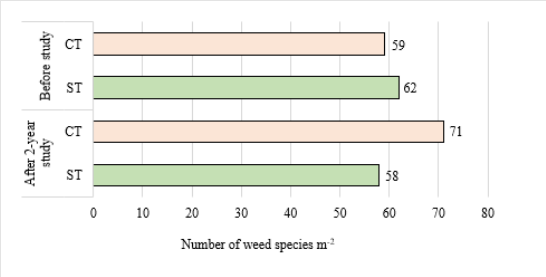

Figure 1: Effect of CT and ST on the weed abundance (number per m^2) after 2-year field trials of Conservation Agriculture (CT: Conventional Tillage, ST: Strip Tillage).

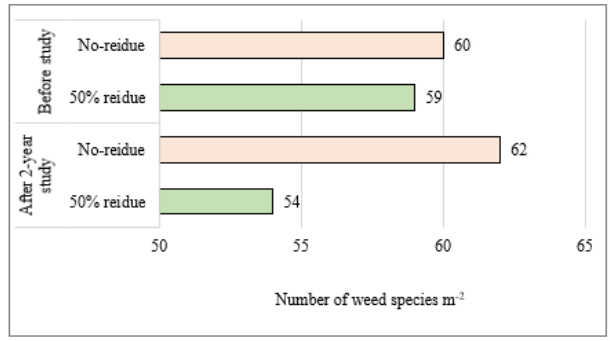

Figure 2: Effect of no-residue and 50% residue mulching on the weed abundance (number per m^2) after 2-year filed trials of Conservation Agriculture.

Results and Discussion

Effect of CT, ST, No-Residue and 50% Residue Mulching on the Weed Abundance (Number Per M^2): Effect of ST and retention of 50% crop residues was significant on the number of weed species. Before setting the long-term CA trials in 2013, there was no significant difference in the weed species for CT and ST. During this time, there was 59 species in CT and 62 species in ST indicating the homogeneity of weed seed bank in the field. After 6 field trials of two-year study, there was 20% higher weed species in CT (71 species) but 7% less species in ST (58 species) (Figure 1). Retention of 50% crop residue in the field caused to decrease the weed species by 9% after 2-year study compared to the before study (Figure 2).

Table 1: Effect of tillages and residues on weed density (number per m^2) at different soil depths.

Soil Depth (cm)	CT		ST		No-residue		50% residue	
	Before Study	After 2-Year Study	Before Study	After 2-year Study	Before Study	After 2-Year Study	Before Study	After 2-year Study
0–5	6189	6890	8301	6323	7082	7194	6838	6241
5–10	1507	1878	1498	1819	1872	1653	2153	1899
10–15	567	269	320	137	349	472	280	116
Total (n)	8263	9037	10119	8279	9303	9319	9271	8256
Dynamism	(+) 13%		(-) 22%		(+) 0.17%		(-) 11%	

Note: CT: Conventional Tillage, ST: Strip Tillage, (+): increase (-): decrease.

Effect of CT, ST, No-Residue and 50% Residue Mulching on the Weed Abundance (Number Per M^2) At Different Soil Depths: The highest weed density was recorded from 0–5 cm depth followed by 5–10 and 10–15 cm depth both in CT and ST during both of before and after field trials (Table 1). After 2-year crop cultivation CT increased the weed density by 13%. Data recorded from after 2-year study also reveals that, heavy pulverization in CT caused to increase density by 11% at 0–5 cm depth and 25% at 5–10 cm depth but decreases by 53% at 10–15 cm depth which might be attributed from continuous upward movement of weed seeds to the upper layer of soil. After 2-year cropping, ST reduced the seed bank size by 22%. It was also found that, ST reduced the weed seeds by 24% at 0–5 cm and 57% at 10–15 cm depth but increased by 25% at 5–10 cm depth. Minimal soil disturbance may cause to emerge the weeds from upper most layer leading to reduce seed bank size and deposition of seed to the middle layer leading to enrich seed bank. Soil compactness at the lowest layer may cause to increase seed dormancy and mortality and reduce seed bank size [5]. Two-year cropping with the retention of 50% residue reduced the seed bank by 11% and there was a decreasing trend in seed

composition from upper to lower soil layer. Residue may cause to hinders the optimal atmosphere for weeds and favors the weeds seed predation by soil fauna and reduce seed bank status [6].

Conclusion

Results of the present on-farms study claimed that two years' continuous practice Conservation Agriculture based on Strip Tillage with the retention of 50% anchored residues of previous crop may lead to reduce soil weed seed bank status. It is recommended to conduct long-term trials across the Agro-ecological Zones of Bangladesh to validate the results.

Declaration of Conflict of Interest

Authors declared that there are no conflicts of interest of any type.

Acknowledgement

The authors like to express their gratitude to the Department of Agronomy at Bangladesh Agricultural University in Mymensingh, Bangladesh, for providing research facilities.

References

1. Bell R, Haque M, Jahiruddin M, Rahman M, Begum M, et al. (2019) Conservation Agriculture for Rice-Based Intensive Cropping by Smallholders in the Eastern Gangetic Plain. Agriculture (Switzerland) 9.
2. Hossain M, Begum M (2015) Soil Weed Seed Bank: Importance and Management for Sustainable Crop Production- A Review. Journal of the Bangladesh Agricultural University 13(2): 221-228.
3. Haque E, Islam A, Hossain M, Bell R, Sayre K (2017) An Innovative Versatile Multi-Crop Planter for Crop Establishment Using Two-Wheel Tractors. Agricultural Mechanization in Asia, Africa and Latin America 48(4): 33-37.
4. Chancellor RJ (1981) The Identification of Weed Seedlings of Farm and Garden. Blackwell Science Inc: Oxford.
5. Hossain MM, Begum M, Hashem A, Rahman MM, Ahmed S, et al. (2021) Strip Tillage and Crop Residue Retention Decrease the Size but Increase the Diversity of the Weed Seed Bank under Intensive Rice-Based Crop Rotations in Bangladesh. Agronomy 11(6): 1164.
6. Alskaf K, Mooney SJ, Sparkes DL, Wilson P, Sjögersten S (2021) Short-Term Impacts of Different Tillage Practices and Plant Residue Retention on Soil Physical Properties and Greenhouse Gas Emissions. Soil and Tillage Research 206: 104803-104803.

ISSN: 2574-1241

DOI: 10.26717/BJSTR.2022.44.007054

Mohammad Mobarak Hossain. Biomed J Sci & Tech Res