



RESEARCH ARTICLE

Distribution pattern of weed seedbank in strip and bed planted sandy clay loam soil after five years of cropping in Bangladesh

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ABSTRACT

Tillage can affect weed seedbank distribution and may be used for integrated weed management. The goal of this shade house experiment was to compare the floristic composition of weeds in the field between strip and bed planting with enhanced residue mulching (20 vs. 50%). The Rajshahi district of Bangladesh had a five-year conservation agricultural experiment. Weed emergence in 0-15 cm soil was measured from January to December 2016. SP had the fewest weed species and BP with 50% mulches. Unlike CT, the SP and BP produced more permanent weeds than annual weeds. Using SP five years reduced the weed seedbank size. Still, they boosted perennial weed growth compared to CT. SP has a smaller weed seedbank than BP.

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INTRODUCTION

Reduced tillage alters the weed seedbank composition, causing alterations in weed communities (Pittelkow et al., 2015). Planting with reduced tillage favours weeds (Singh et al., 2015). These weeds proliferate by underground tubers and rhizomes that are not buried deeply enough or are not uprooted and killed (Aweto, 2013). According to Nichols et al. (2015), RT would gain perennial dicot species while losing annual dicot species.

Strip and bed planting were used in Bangladesh in 2005 (Hossain et al., 2015) to test the impact of CA principles on small farms. RT methods alter the weed seedbank, causing eventual weed problems. The effect of SP, BP, and crop residue retention on soil weed seedbanks may be useful for CA sustainable weed management. Soil weed seedbank was examined from five years longer CA trials done in Rajshahi district of Bangladesh to discover the pattern of weed seedbank response to CA principles. So that CA could be widely used and propagated, it was needed that knowledge about weed seedbanks be gained.

MATERIALS AND METHODS

Shade house research experimental location and environment

Temperatures were hot and humid with heavy monsoon rain and gusty winds from April to September, then cool and dry from October to March. April-June sees high temperatures of 32.3-33.5°C, with January being the coolest. From April through September, this place received 95% rainfall. Due to the rainy weather, the sunshine hours varied greatly.

Long-term CA trial sites and times

The five-year CA study was undertaken in Bangladesh's Durgapur sub-district, at 24° 22' N and 88° 36' E. Experiments with summer rice, mustard, and winter rice in 2010-2015.

Long-term CA trials in Rajshahi

Crops were cultivated using normal tillage, strip planting, and bed planting with 20% and 50% standing residue mulches, respectively. Four replications of 20 and 50% standing previous crop mulches were kept. Previous crops were harvested, leaving 20-50 percent of plants standing.

Rajshahi's weeding regimens

Hand weeding was used in all crops in CT. Rice and wheat were weeded three times at 25, 45, and 65 DAT/S, whereas jute was weeded twice at 25 and 45 DAS. In SP and BP, weeds were managed using specific pesticides for each crop. Three days before tillage and three DAT/S were used in all crops. 100 g ethoxysulfuron-ethyl and 1.25 kg carfentrazone-ethyl+isoproturon were applied to rice and wheat at 25 DAT/S. 15 DAS @ 2.5 L isoproturon in mustard 650 mL Fenoxaprop-p-ethyl was applied at 25 DAS in mungbean, lentil, and jute. Herbicides' total dose was ha-1.

Shade house soil sampling and experimental setup

The field soil was taken from 0-15 cm deep. Five samples from each plot, totaling 96 samples, were obtained using a five-centimetre diameter stainless steel pipe (Chancellor, 1966). After sampling, the weed pieces were labelled and bagged for the shade house. Trays were placed in the shade house in a completely random pattern, four times. The shade house has 96 trays.

Data mining

The Duncans' Multiple Range Test was used to differentiate treatment means at P0.05. STAR was utilised to analyse the research data.

RESULTS

The CT with 20% mulch produced 29 species, 19 broadleaf, 5 grass, and sedges each, 25 annuals and 4 perennials (Table 1). Perennials outnumbered annuals. 18 species detected in SP plus 50% mulch, ten broadleaf, four grass, and sedges, 13 annuals and five perennials. The BP produced 25 species, 15 broadleaf, four grass, and six sedges, 20 annuals and five perennials. SP had the fewest weed species,

followed by BP and CT. 50% mulch retained less weeds than 20% mulch.

The CT produced the most weed, followed by BP and SP. Compared to CT (8588), SP has 2746 less weeds than BP (Table 2). SP (5882) also had 1274 less marijuana than BP. 50% mulch retention yielded 610 fewer weeds than 20% mulch retention. Broadleaf weeds outnumbered sedges in all tillage types, save SP and BP. Perennials beat annuals in CT, whereas annuals beat perennials in SP and BP (Figure 1).

DISCUSSION

In this study, CT had more weeds composting broadleaf, grass, and sedge kinds than SP, possibly due to more weed species emerging in CT. According to Liebman & Mohler (2001), scarification, ambient CO₂, and greater nitrate concentrations cause latent seeds to sprout in CT, increasing weed emergence of new weed species. Cardina et al. (2002) found that weed seed burying in the soil profile increased weed species composition in CT. It's possible that increased weed seed survival will enhance weed composition in CT.

Just 20% of the upper soil layer of the SP is disturbed. Desiccation and harsh environment can kill them, according to Nichols et al (2015). It is possible that enhanced seed dormancy at an undisturbed deeper

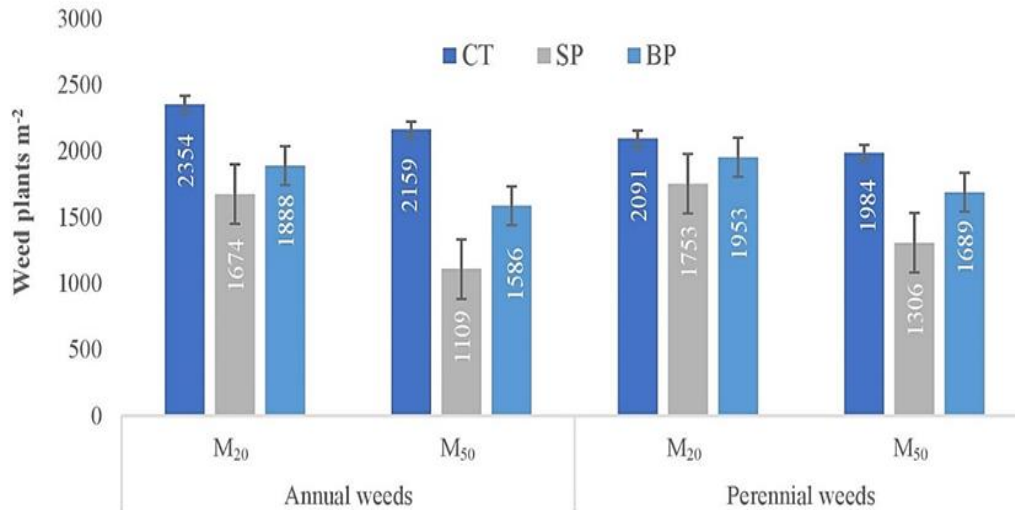


Figure 1. Distribution of annual and perennial weeds in different tillage and residue levels

Weed seeds require air and light to germinate, thus seeds in deeper layers suffer from suffocation and darkness (Oziegbe et al., 2010).

Moreover, different pesticides may reduce weeds in SP, BP, and CT. All crops in the long-term CA experiment had glyphosate pendimethalin. Carfentrazone-ethyl+isoproturon (wheat), isoproturon (mustard), fenoxaprop-p-ethyl (jute). These pesticides diminish seed viability/induced seed dormancy in weeds in ST rather than CT. Depending on the biotype, herbicides can diminish seed production and germination by many fold. Pendimethalin herbicide inhibited 30.57 percent seed germination in *Chenopodium album* L. (Tanveer et al., 2009; Opea et al., 2014).

As a result of the factors stated above, SP may have a smaller weed seedbank than CT and BP. Barberi & Lo Cascio (2001) concurred with the present study's findings, due to higher weed seedling recruitment from the topsoil.

Annual weeds outnumbered perennials in CT. several investigations back with our findings that CT systems favour annuals whereas RTS favour perennial weeds Tuesca et al (2001). Our research findings support the domination of perennial weeds (Aweto, 2013). Because CT destroys perennial weeds' underground reproductive organs (rhizomes, tubers, bulbs, runners, and stolons), it leaves mainly annual weeds that reproduce mostly by seed (matured ovules). However, in SP and BP, tillage was limited, favouring perennial weeds.

In this study, 50% agricultural residue had fewer weed taxa than 20% mulch. Furthermore, less light penetration cools soil, reducing weed seed germination or delaying germination (Tuesca et al., 2001). Also, predation and breakdown by macro and microbes (Conklin et al., 2002) and etiolated plants emergence delayed (Begum et al., 2006).

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