Int.J.Curr.Microbiol.App.Sci (2024) *13*(05): 76-81

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 13 Number 5 (2024)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2024.1305.011

Weed Dynamics and Rice Productivity under Various Tillage Practices in North East India

Puscal Sharma[1]*, T. T. Bhutia[1], Buddhadeb Duary[2], Meena Pradhan[1], Rinchen Doma Bhutia[1], Palden Bhutia[1] and Karma Doma Bhutia[1]

[1]Krishi Vigyan Kendra Mangan North Sikkim-737 116
[2]Palli Siksha Bhavana Visva Bharati Santiniketan

**Corresponding author*

Keywords

Lower Dzongu, Sikkim, Weed dynamics, Conservation agriculture, Tillage

Article Info

Received:
20 March 2024
Accepted:
26 April 2024
Available Online:
10 May 2024

A B S T R A C T

A field experiments were conducted during the *kharif* (wet) season of 2020 and 2021 at farmers field of lower Dzongu North Sikkim, India with rice variety abhishek a high yield variety developed from CRRI Cuttack for the study of weed dynamics and rice productivity under various tillage practices in North East India. From the experimental findings it revealed that rice field was infested with three categories of weeds viz. grassy, broadleaved and sedges were predominant throughout the cropping period. Results revealed that the amongst the tillage practices, minimum population of all weed flora (grasses, sedges and broadleaved) was recorded with no till at 30 DAP. This leads to about 16.9%, 11.6% and 23.1% reduction in grasses, sedges and broadleaved weeds over the conventional practices, respectively. However, at 60 DAP reverse scenario of weed dynamics has been observed in grasses and broad leaved. Similar trend was observed in case of dry weight. Grain yield was also significantly influenced by different tillage and organic nitrogen sources and the highest yield was recorded with NT (3.38 t/ha) followed by RT (3.25 t/ha) and lowest in CT (3.14 t/ha). With regard to organic sources of nutrients, application of 50% FYM+50% VC + Biofertilizer 100% RDN through (VC) recorded significantly maximum grain yield (3.68 t/ha) over other organic sources.

Introduction

Rice is the major staple food for over three billion people, representing the major carbohydrate and protein source not only in South East Asia, but also in some parts of Africa (Gill *et al.,* 2013). In India rice is grown over 42.4 million ha area with the production of 104.40 million tons and a productivity of 2.46 tons ha^{-1}. Rice is the second important crop after maize in Sikkim, however, its productivity is quite low (37%) than the national average. Area under rice crop in the state is 10.67 thousand hector with production 19.69 thousand tones and productivity 1845.25 kg/ha (Anonymous, 2017). Low productivity of rice in India is a major concern for food and nutritional security of more than 60% population which is dependent on rice (Ram *et al.,* 2014). Mountainous ecosystem of the state enjoyed very high rainfall during *Kharif* season which favoured weed

growth Weeds pose a major threat for increasing productivity. Therefore, weed infestation is a major challenge to sustain the rice productivity especially under organic management conditions (Iwaishi *et al.,* 1998). Further, intensive tillage practices may also aggravate weed problems in hilly production system. Uncontrolled weed growth caused 33-45% reduction in grain yield of rice (Manhas *et al.,* 2012). However, crop damage is depending upon the intensity of weeds and cultural practices adopted by the farmers. Farmers of the state mainly grow transplanted puddled rice with poor agronomic management practices; hence crop yields are low, however, the quantum of resources used per unit of production is very high. Tillage practices contribute greatly to the labour cost in modern intensive agriculture in any crop production system resulting in lower economic returns (Jat *et al.,* 2005). Acute shortage of water, labour and energy resources, along with faulty crop management practices and the adverse effects of conventional tillage on the soil health, as well as declining of profitability is the major challenge towards the resource poor farmers of the state. There are very few studies that systematically examine both the direct and interactive effects of the three CA principles on weed dynamics (Chauhan *et al.,* 2012; Farooq *et al.,* 2011). Hence the present investigation was undertaken.

Materials and Methods

A field experiments were conducted during the *kharif* (wet) season of 2020 and 2021 at farmers field of lower Dzongu North Sikkim, India with rice variety abhishek a high yield variety released from CRRI Cuttack with rice variety abhishek for the study of weed dynamics and rice productivity under various tillage practices in rice-vegetable pea cropping system of North East India. The soil of the experimental field was sandy loam in texture, slightly acidic in reaction (pH 5.8), medium in organic carbon (1.08%) and available Nitrogen (222.6 kgha-1), medium in available Phosphorous (20.42 kgha-1) and medium in available Potassium (129.5 kgha-1).

The experiment was laid out in split-plot design, assigning three tillage practices *viz.,* conventional (CT), reduced (RT) and no till (NT) in main plots and four recommended dose of nitrogen organic sources *viz.,* control (FP), 100% N through farm yard manure (FYM) + biofertilizer (BF), 100% N through vermicompost (VC) + BF and 50% N through FYM + 50% N through VC+ BF to sub-plots. Field was prepared as per the treatment for planting of rice. The crop was grown as per the recommended package of practices of the region and harvested in first fortnight of November. The data on weed density and dry weight of different weed flora m^{-2} were recorded at different growth stages of rice crop. These were subjected to square root transformation to normalize their distribution. Grain yield of rice along with other yield-attributing characters like effective panicles m^{-2} were recorded at harvest and statistically analyzed at 5 per cent level of significance.

Results and Discussion

Weed flora

The experimental field was infested with three categories of weeds under eight families. The total number of weed species was six out of which *Cynodon dactylon, Echinochloa spp,* among the grasses*; Fimbristylis miliacea* among the sedges *Commelin anudiflora,* among the broadleaved weeds were present as major weeds throughout the cropping growth period.

Effect on weed dynamics

The results (Table 1) revealed that the weed dynamics significantly affected by tillage practices at all the stages of crop growth (30 and 60 days after planting). Amongst the tillage practices, minimum population of all weed flora (grasses, sedges and broadleaved) was recorded with no till at 30 DAP. This leads to about 16.9%, 11.6 and 23.1% reduction in grasses, sedges and broadleaved weeds over the conventional practices, respectively. However, at 60 DAP reverse scenario of weed dynamics has been observed in grasses and broadleaved. Organic sources of nutrient failed to show any significant effects on weed population at both the growths stages of rice.

Similar trend was observed in case of dry weight (Table 2). Weed dry weight significantly affected by tillage practices at all the stages of crop growth (30 and 60 DAP) and organic sources of nutrient failed to show any significant effects on weed dry wt. Results in the experiments are in line with the previous findings of Rajkumari *et al.,* (2017), who observed that weed dynamics significantly affected by tillage practices.

Effect on crop productivity

Proper control of weeds reduced the weed density which facilitated the crop plants to have sufficient space, light, nutrient and moisture and thus the tillers m^{-2}, number of

panicles m^{-2} and number of filled grains per panicle increased. There was about 40% yield reduction due to weed competition in transplanted *kharif* rice.

Similar yield reduction in wet season rice due to weed competition was also reported by Mandal *et al.,* (2013) and Hossain *et al.,* (2010). No. of panicles/ hill, No. of grains/ panicle and Test wt. was significantly influenced by different tillage and organic nitrogen sources (Table 3). Grain yield was also significantly influenced by different tillage and organic nitrogen sources and the highest yield was recorded with NT(3.38 t/ha), followed by RT (3.25t/ha) and lowest in CT(3.14 t/ha). With regard to organic sources of nutrients, application of 50% FYM+50% VC + Biofertilizer 100% RDN through (VC) recorded significantly maximum grain yield (3.68 t/ha) over other organic sources. Higher grain yield in NT and 50% FYM+50% VC + Biofertilizer 100% RDN through (VC) treated plots may be an outcome of efficient weed control achieved there. Ultimately it resulted in higher BC ratio.

To conclude from the above finding, it can be stated that the no tillage with recommended dose of nitrogen substituted in 1:1 ratio of FYM and VC + BF (50% FYM + 50% VC + biofertilizer) can effectively control different categories of weeds, especially of sedge and broad leaved weeds in transplanted rice field and enhancing rice productivity under organic management condition of Sikkim Himalayas.

Table.1 Effect of tillage practices and organic nitrogen sources on weed density and productivity of rice. (Mean data of two years)

Treatment	Weed density (no./m^2)					
	Grasses		Sedges		Broadleaved	
	30 DAP	60 DAP	30 DAP	60 DAP	30 DAP	60 DAP
Tillage practices						
Conventional tillage (CT)	7.25 (52.3)	8.00 (63.5)	6.93 (47.5)	6.96 (48.1)	4.91 (23.7)	4.92 (23.8)
Reduced tillage (RT)	6.98 (48.4)	8.41 (70.3)	6.77 (45.4)	7.30 (52.9)	4.27 (17.9)	5.19 (26.7)
No Tillage (NT)	6.20 (38.8)	8.71 (75.4)	6.21 (38.2)	7.70 (59.0)	3.99 (15.5)	5.38 (28.7)
SEm±	0.10	0.12	0.14	0.14	0.21	0.17
LSD (*P*=0.05)	0.25	0.30	0.33	0.33	0.51	NS
Organic nitrogen sources						
Farmers practice	6.96 (48.2)	8.38 (69.9)	6.60 (43.3)	7.35 (53.7)	4.49 (20.0)	5.07 (25.3)
100 % RDN through (FYM)	7.00 (49.2)	8.56 (72.9)	6.80 (45.8)	7.41 (54.8)	4.52 (20.1)	5.36 (28.3)
100 % RDN through (VC)	6.41 (40.9)	8.25 (67.8)	6.50 (41.9)	7.22 (52.9)	4.19 (17.3)	5.01 (24.9)
50% RDN (FYM)+ 50 % RDN (VC)	6.87 (46.9)	8.29 (68.3)	6.64 (43.8)	7.30 (53.0)	4.35 (18.7)	5.22 (26.7)
SEm±	0.20	0.12	0.15	0.16	0.15	0.16
LSD (*P*=0.05)	NS	NS	NS	NS	NS	NS

Data subjected to square root (x + 0.5) transformation; Values in parentheses are original.

Table.2 Effect of tillage practices and organic nitrogen sources on weed dry wt. and productivity of rice (Mean data of two years).

Treatment	Weed dry wt. (g/m^2)					
	Grasses		Sedges		Broadleaved	
	30 DAP	60 DAP	30 DAP	60 DAP	30 DAP	60 DAP
Tillage practices						
Conventional tillage (CT)	4.08 (16.16)	4.68 (21.37)	3.47 (11.51)	3.55 (12.08)	5.33 (27.94)	6.32 (39.43)
Reduced tillage (RT)	4.05 (15.88)	4.89 (23.41)	3.34 (10.66)	3.59 (12.41)	4.78 (22.32)	6.35 (39.81)
No Tillage (NT)	3.92 (14.84)	5.02 (24.57)	3.24 (10.03)	3.72 (13.34)	4.70 (21.60)	6.46 (41.22)
SEm±	0.01	0.01	0.02	0.01	0.01	0.04
LSD (*P*=0.05)	0.02	0.01	0.04	0.01	0.03	0.08
Organic nitrogen sources						
Farmers practice	3.42 (11.22)	4.25 (17.54)	3.47 (11.57)	3.46 (11.48)	5.12 (25.68)	7.40 (54.2)
100 % RDN through (FYM)	3.24 (9.98)	4.14 (16.64)	2.95 (8.18)	3.03 (8.71)	4.82 (22.71)	6.13 (37.13)
100 % RDN through (VC)	3.06 (8.86)	3.21 (12.39)	2.58 (6.17)	2.90 (7.9)	4.76 (22.16)	5.94 (34.82)
50% RDN (FYM)+ 50 % RDN (VC)	3.08 (9.01)	3.72 (13.36)	2.65 (6.50)	2.97 (8.33)	4.78 (22.20)	6.07 (36.4)
SEm±	0.01	0.01	0.01	0.01	0.02	0.03
LSD (*P*=0.05)	NS	0.02	NS	NS	0.03	0.06

Data subjected to square root (x + 0.5) transformation; Values in parentheses are original.

Table.3 Effect of treatments on weed control efficiency, yield attributes, yield and economics of transplanted rice (Mean data of two years).

Treatments	WCE at 60 DAP	No. of panicles/ hill	No. of grains/ panicle	Test weight (g)	Grain yield (t/ha)	Net return (x10^3 `/ha)	B:C ratio
Tillage practices							
Conventional tillage (CT)	4.28	12.72	64	21.16	3.14	31.28	1.80
Reduced tillage (RT)	2.43	12.99	68	22.62	3.25	34.08	2.10
No Tillage (NT)	0.0	13.29	77	22.94	3.38	36.14	2.38
SEm±	-	0.35	6.6	0.43	0.03	3.0	0.05
LSD (*P*=0.05)	-	NS	8.3	1.25	0.09	5.2	0.08
Organic nitrogen sources							
Farmers practice	0.0	11.8	67	20.2	2.64	29.28	1.70
100 % RDN through (FYM)	11.98	12.3	70	20.9	3.12	32.38	2.02
100% RDN through (VC)	20.25	12.72	74	21.16	3.38	34.98	2.35
50% RDN (FYM)+ 50 % RDN (VC)	15..55	15.1	80	22.4	3.68	36.45	2.45
SEm±	-	0.60	6.9	0.74	0.06	3.3	0.06
LSD (*P*=0.05)	-	NS	8.5	2.17	0.13	5.6	0.12

Acknowledgement

This study is the outcome of On Farm trial sponsored by ICAR- Agricultural Technology Application Research Institute Zone-VI (India). Authors acknowledge the financial support and technical support from PSB Visva Bharati Sriniketan. Authors also express their thanks to farmers of Lower Dzongu associated with the programme for their cooperation.

Author Contribution

Puscal Sharma: Investigation, formal analysis, writing—original draft. T. T. Bhutia: Validation, methodology, writing—reviewing. Buddhadeb Duary:—Formal analysis, writing—review and editing. Meena Pradhan: Investigation, writing—reviewing. Rinchen Doma Bhutia: Resources, investigation writing—reviewing. Palden Bhutia: Validation, formal analysis, writing—reviewing. Karma Doma Bhutia: Conceptualization, methodology, data curation, supervision, writing—reviewing the final version of the manuscript.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

References

Anonymous 2017. Rice: Area, Production and Productivity of Rice in Sikkim. ENVIS Centre: Sikkim Status of Environment and Related Issues Hosted by Forests, Environment & Wildlife Management Department, Government of Sikkim, Sponsored by Ministry of Environment, Forests & Climate Change, Govt of India.

Chauhan B S, Singh R G and Mahajan G, 2012. Ecology and management of weeds under conservation agriculture: a review. *Crop Prot.*38: 57-65. https://doi.org/10.1016/j.cropro.2012.03.010

Farooq M, Flower K, Jabran K, Wahid A, Siddique K H. 2011. Crop yield and weed management in rainfed conservation agriculture. *Soil Tillage Res.*117: 172-183. https://doi.org/10.1016/j.still.2011.10.001

Gill J S and Walia S S. 2013. Effect of foliar application of iron, zinc and manganese on direct seeded aromatic rice (*Oryza sativa*).*Indian Journal of Agronomy* 59(1):80-85.

Hossain A, Duary B and Mondal D C. 2010. Effect of weed management under different methods of rice establishment in the lateritic soil of West Bengal. *In*: *Extended summaries of Biennial Conference of Indian Society of Weed Science on "Recent Advances in Weed Science Research 2010",* February 25 26, 2010, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgargh). p.63.

Iwaishi S, Kato S, Fujita M, Iwahori H and Takabayashi M. 1998. Applications of characteristics of suppressive paddy soil under cultural weed control.-Relations between soil inorganic nitrogen and weed emergence rate. *J. Weed Sci. Tech.* 43: 250-251.

Jat M L,Srivastava A, Sharma S K,Gupta R K, Zaidi P H, Rai H K and Srinivasan G. 2005. Evaluation of maize-wheat cropping system under double no till practice in Indo-gangetic plains in India. Proceedings of 9th Asian Regional maize workshop, September 5-9, 2005, Beiging, China, pp: 25-26.

Mandal M K, Duary B and De G C. 2013. Effect of crop establishment and weed management practices on weed growth and productivity of Basmati rice. *Indian Journal of Weed Science* 45(3):166-170.

Manhas S S, Singh G, Singh D and Khajuria V. 2012. Effect of tank-mixed herbicides on weeds and transplanted rice (*Oryza sativa* L.). *Annals of Agricultural Research New Series* 33(1&2):25-31.

Rajkum Rajkumari, Shankar Lal Khaswan, Arun Kumar, Kapil Kumar and Sharwan Singh Thori. 2017. Influence of different tillage and weed management practices on growth parameters and chlorophyll content of soybean in sub humid Rajasthan. Journal of Pharmacognosy and Phytochemistry. 6(4): 1793-1796.

Ram H, Singh J P, Bohra J S, Singh R K and Sutaliya J M. 2014. Effect of seedlings age and plant spacing on growth, yield, nutrient uptake and economics of rice (*Oryza sativa*) genotypes under system of rice intensification. *Indian Journal of Agronomy* 59(2):256-260. https://doi.org/10.59797/ija.v59i2.4547

How to cite this article:

Puscal Sharma, T. T. Bhutia, Buddhadeb Duary, Meena Pradhan, Rinchen Doma Bhutia, Palden Bhutia and Karma Doma Bhutia. 2024. Weed Dynamics and Rice Productivity under Various Tillage Practices in North East India. *Int.J.Curr.Microbiol.App.Sci.* 13(5): 76-81. **doi:** https://doi.org/10.20546/ijcmas.2024.1305.011