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AGRONOMY

Weed Dynamics of Hybrid Rice under the Influence of Fertilizer Levels and Weed Management Practices

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ABSTRACT

A field experiment entitled "Weed Dynamics of Hybrid Rice under the Influence of fertilizer Levels and Weed Management Practices" was conducted during the *Kharif* season of 2017 at the Research Farm, TCA, Dholi, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur (BIHAR). The experiment was laid out in a split-plot design with twelve treatments. Among different levels of fertilizer, application of 100 % RDF recorded a minimum number of weeds/m^2 (58.36/m^2), weed dry weight production (73.12 g/m^2), and weed growth rate (0.024 g/m^2/day). In the case of weed management practices, Hand weeding (twice) was found to be the most efficient weed control (71.32%), a minimum number of weeds/m^2 (25.11/m^2), weed dry weight production (21.12 g/m^2) and weed growth rate (0.011 g/m^2/day) but the minimum weed index (45.87%) was observed in weedy check.

HIGHLIGHTS

- Application of 100% RDF and Hand weeding (twice) recorded a minimum number of weeds/m^2.
- Weed dry weight production and weed growth rate.
- Hand weeding (twice) was found higher weed control efficiency over the weedy check.

Keywords: Weed control efficiency, weed index, RDF, hand weeding and weedy check

Rice crop suffers from various constraints in production, and most important among them is the competition through weeds. Weed management is essentially the most important aspect of the successful cultivation of rice. Weeds are widely regarded as pests of great agricultural menace as they pose serious problems by causing severe competition with crop plants for nutrients, moisture, solar energy, and space. So, weeds bring heavy reductions in the growth and yield of the crop. Hand pulling of weeds is time consuming, cumbersome, and costly alternative. In most crops, the farmers spend more of their time fighting these agricultural misfits than any other farm operation. Weeds also increase the cost of operations such as harvesting, drying, cleaning and increase insect pest and disease infestation.

Yield reduction in transplanted rice has been reported to be 28-45% due to uncontrolled weeds (Singh *et al*. 2003). Besides yield reduction, weeds deplete nutrients from soil to the extent of 42.07 kg nitrogen, 10 kg phosphorous, and 21.08 kg potassium per hectare, respectively (Puniya *et al*. 2007). Weed management is an important component of plant protection, improving the production potential of crops. It includes the management of weeds in a way that the crop sustains its production potential without being harmed by the weeds. General agriculture losses due to detrimental factors have been given below- Gupta, O.P. (2014).

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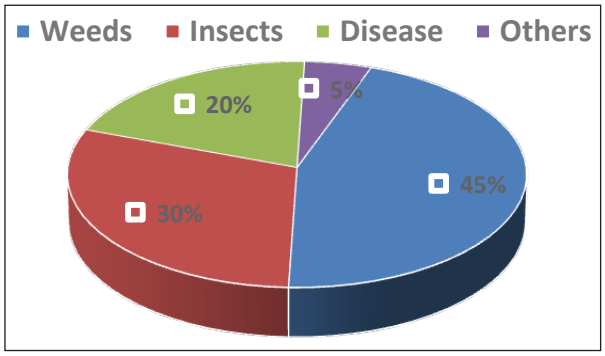

Fig. 1: Agriculture losses by detrimental factors

The extent of damage caused by weeds in a particular crop depends on weed flora, weed intensity, and weed growth. Transplanted rice faces diverse types of weed flora consisting of grasses, broad-leaved weeds, and sedges. Depending on the intensity of weed infestation, yield losses in transplanted rice may vary from 29 to 63 percent (Nalini *et al*. 2012). Weeds left uncontrolled may create problems in the field preparation and sowing operations in the succeeding crop. In India, the extent of yield reduction in transplanted rice due to weeds alone has been reported to be from 10 to 70 percent.

So, control of weeds is most important that can be accomplished by cultural, mechanical, and chemical methods. Out of three, the chemical method is more efficient in time and quickly controlling of weeds. The chemical method is vital for effective and efficient control of weeds where weeds compete with the main crop for light, nutrients, water and space, and other growth factors. In spite of the usage of several herbicidal combinations, a lot of escapes or regeneration has been noticed. Therefore, considering the long window of the emergence of diverse types of weeds, it can't be solved by the one-time application of herbicides alone. Considering these problems, application of several herbicides in combination or in sequence can be utilized in controlling complex and diverse weed flora.

Essential plant nutrients also play a vital role in boosting the yield of hybrid rice. It responds to judicious application of fertilizer, especially nitrogen, phosphorous, and potassium, and gives higher yield from high yielding varieties (HYVs) at particular fertilizer level (Singh and Virmani 1990) and reduces the growth and nutrient removal by weeds at the utmost level.

Hence, the present investigation was carried out to assess *"Weed Dynamics of Hybrid Rice under the Influence of fertilizer Levels and Weed Management Practices"*.

MATERIALS AND METHODS

A field experiment was conducted during *Kharif* season of 2017 at the Research Farm of Tirhut College of Agriculture, RPCAU, Dholi, Samastipur (Bihar). The soil of the experimental site was sandy loam in texture (sand 56.72 %, silt 28.45 %, and clay 14.83 %) with a bulk density of 1.38 Mg m^{-3} having pH 8.2.

The experiment was laid out in a split-plot design with weed management in main-plot and fertilizer levels in sub-plot with three replications. The descriptions of the treatment with corresponding symbols in order to facilitate their reference in the text are given below.

A . Weed management practices (main–plots)

W_1 : Bispyriback sodium @ 25 g /ha at 20 DAT

W_2 : Bispyriback sodium @ 25 g /ha + Pyrazosulfuron @25 g/ha at 20 DAT

W_3 : Hand weeding twice (20 and 40 DAT)

W_4 : Weedy check

B. Fertilizer levels (sub–plot)

F_1 : 100 % RDF.

F_2 : 125 % RDF.

F_3 : 150 % RDF

RESULTS AND DISCUSSION

Effect on weed management practices

1. Weed density

A perusal of data regarding a number of weed count indicated that weed management practices exerted a significant effect on weed count. All the weed management practices recorded a significant weed count than weed check (216.15/m^2). Among the weed management practices, the minimum weed count was recorded in hand weeding twice (25.11/m^2) but was found at par with the combined approach of Bispyribac-sodium @ 25 g/ha + Pyrazosulfuron @ 25 g/ha (33.80/m^2) and significantly superior to application of Bispyribac-

sodium @ 25 g/ha alone (80.79/m^2). This might be to hand weeding shows significantly superior reason hiding behind was that in herbicide treatments weed control decreases slowly due to the decreasing the efficiency of the herbicide with the lapse of time towards crop maturity because of non-persistence or degradation of applied herbicide to the soil. Further, many vegetatively propagated sedges and grasses emerged with the growth and development of the crop.

The calculated mean data revealed that fertilizer level had a significant effect on weed count. Application of 100% RDF (58.36/m^2) lowest weed density which was found significantly lower than the rest of the fertilizer levels 125 % RDF (78.00/m^2) and 100 % RDF (88.95/m^2). The weed population was increased with increasing level of fertilizer may be due to good establishment growth and development of weeds under high nutrient supply.

2. Weed dry weight production

The calculated data regarding dry weed weight indicated that weed management practices exerted a significant effect on weed dry weight production. All the weed management practices recorded significant weed dry weight production than weed check (299.48 g/m^2). Among the weed management practices, the minimum weed dry weight production was recorded in hand weeding twice (21.12 g/m^2), which was significantly lower than a combined approach of Bispyribac-sodium @ 25 g/ha + Pyrazosulfuron @ 25 g/ha (47.11 g/m^2) Bispyribac-sodium @ 25 g/ha alone (95.93 g/m^2). Hand weeding twice effectively controlled the weed population, and late flushes of weeds nearly failed to emerge after second-hand weeding which might be responsible for recording the lower weed dry weight. Herbicidal mixture (Bispyribac-sodium @ 25 g/ha + Pyrazosulfuron @ 25 g/ha) also showed a significant effect in lowering weed dry matter production due to suppression of weed population at an early stage of crop growth because of their broad-spectrum activity that controlled most of the weed species. Later, some of the weeds come up due to the regeneration and regrowth of weeds because of the loss of persistency of herbicides in the soil with the lapse of time. This finding was corroborated by Walia *et al*. (2008).

The calculated mean data revealed that fertilizer level had a significant effect on weed dry weight production. Application of 100 % RDF (73.12 g/m^2) recorded minimum weed dry weight production where was maximum weed dry weight was recorded in 150 % RDF (108.70 g/m^2) but was found at par with 125 % RDF (98.10 g/m^2). Due to the availability of high nutrient weeds, rob a huge quantity of nutrients and grew luxuriously; hence, the more dry matter was accumulated. These findings are in conformity with those reported by Dwivedi *et al*. (2006)

Table 1: Weed count/m^2, weed dry weight g/m^2, Weed growth rate (g/day/m^2), and Weed Index (%) as affected by different treatments

Treatments	Weed dynamics at harvest				
	Weed count/m^2	Weed dry weight g/m^2	Weed growth rate (g/day/m^2)	Weed control efficiency (%)	Weed index (%)
Weed Management					
W_1	9.01 (80.79)	9.82 (95.93)	0.031	38.50	19.12
W_2	5.85 (33.80)	6.90 (47.11)	0.018	59.66	3.14
W_3	5.06 (25.11)	4.65 (21.12)	0.011	71.32	—
W_4	14.71 (216.15)	17.32 (299.48)	0.061	—	45.87
S. Em.±	0.34	0.14	0.005		
CD (P=0.05)	1.21	0.50	0.017		
Nutrients levels					
F_1	7.67 (58.36)	8.58 (73.12)	0.017	—	—
F_2	8.86 (78.00)	9.93 (98.10)	0.024	—	—
F_3	9.45 (88.95)	10.45 (108.70)	0.017	—	—
S. Em.±	0.34	0.30	0.005	—	—
CD (P=0.05)	1.02	0.88	NS		

3. Weed growth rate

The calculated data on weed growth rate indicated that weed management practices exerted a significant effect on weed growth rate. All the weed management practices recorded a significantly lower weed growth rate than weed check (0.061 g/m^2/day). Among the weed management practices, the minimum weed growth rate was recorded in hand weeding twice (0.011 g/m^2/day) but was found at par with the combined approach of Bispyribac-sodium @ 25 g/ha + Pyrazosulfuron @ 25 g/ha (0.018 g/m^2/day) and significantly lower to application of Bispyribac-sodium @ 25 g/ha alone (0.031 g/m^2/day).

The calculated mean data revealed that fertilizer level could not exert a significant effect on the weed growth rate at this stage. Application of 125% RDF (0.024 g/m^2/day) recorded maximum weed growth rate found at par with 150 % RDF (0.017 g/m^2/day) and 100 % RDF (0.017 g/m^2/day). This might be due to comparatively favorable conditions for weeds to grow at 60 DAT thereafter, conditions for weed growth getting worse over time due to closing of crop canopy and hence, the more smothering effect of the crop on weeds.

4. Weed control efficiency

The calculated mean data showed that maximum weed control efficiency was obtained under the treatment hand weeding twice, while minimum weed control efficiency was associated with Bispyribac-sodium @ 25 g/ha. In hand weeding twice, maximum weed control efficiency was due to lower weed density and weed dry matter production because effective ground coverage with well-developed crop canopy intercepting solar energy reduced the emergence of weeds. Bispyribac-sodium @ 25 g/ha + Pyrazosulfuron @ 25 g/ha also showed better weed control efficiency next to hand weeding twice that might be due to effective control of monocot and dicot weeds due to the combined effect of two herbicides having different modes of action used in an herbicidal mixture.

5. Weed Index (%)

Based on grain yields, weed index was calculated, and the lowest weed index was observed under Bispyribac-sodium @ 25 g/ha + Pyrazosulfuron @ 25 g/ha and was followed by Bispyribac-sodium @ 25 g/ha. However, maximum weed index was reported in treatment weedy check. This indicated that Bispyribac-sodium @ 25 g /ha + Pyrazosulfuron @ 25 g/ha weed control treatment played a prominent role in minimizing the weed competition resulting in higher grain yield of hybrid rice. A similar trend was obtained by Rishi raj *et al.* (2016).

CONCLUSION

Among different levels of fertilizer, Application of 100 % RDF recorded a minimum number of weeds/m^2 (58.36/m^2), weed dry weight production (73.12 g/m^2), and weed growth rate (0.024 g/m^2/day). In the case of weed management practices, Hand weeding (twice) was found to be the most efficient weed control (71.32%), a minimum number of weeds/m^2 (25.11/m^2), weed dry weight production (21.12 g/m^2) and weed growth rate (0.011 g/m^2/day) but the minimum weed index (45.87%) was observed in weedy check.

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