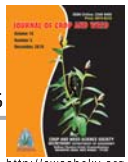
Journal of Crop and Weed, 16(2): 166-170 (2020)

ISSN- O : 2349 9400 ; P : 0974 6315



http://cwssbckv.org
www.cropandweed.com

Efficacy of different nitrogen levels and herbicides on weed dynamics in basmati rice under temperate conditions of Kashmir valley

R. NISSAR, [1]M. A. GANAI AND [2]A. HUSSAIN

Division of Agronomy, Faculty of Agriculture, SKUAST-Kashmir, Wadura-193201, J&K
[1]KVK, SKUAST-Kashmir, Anantnag, J&K [2]MRCFC, SKUAST-Kashmir, Khudwani, J&K

Received : 01.06.2020 ; Revised : 07.07.2020 ; Accepted : 18.07.2020

DOI : https://doi.org/10.22271/09746315.2020.v16.i2.1332

ABSTRACT

A Field experiment was conducted at Mountain Research Center for Field Crops (MRCFC), Khudwani, during Kharif 2018 on silty clay loam soil to evaluate three nitrogen levels(0, 45 & 90 kg N ha^{-1})and five weed management practices. Florpyrauxifen-benzyl (Rinskor, W_1) @ 31.25 ml ha^{-1} and penoxsulam (Granite 240 SC, W_2) @ 22.5 g ha^{-1}were applied as early post emergence herbicides at 10 days after transplanting (DAT), and pyrazosulfuron-ethyl @ 60 g ha^{-1} + pretilachlor @ 300 g ha^{-1} (Eros, W_3) as a pre-emergence herbicide at 3 DAT besides, weed free (W_4) and weedy check (W_5) were tested to ascertain the most effective nitrogen level and herbicide for control of weeds in basmati rice (Shalimar Sugandh 1). Nitrogen levels showed a non-significant effect on the weed densities however, 90 kg N ha^{-1}application resulted in highest weed dry matter and lowest weed index. Penoxsulam @ 22.5 g ha^{-1} significantly controlled nearly all the weeds in basmati rice, followed by pyrazosulfuron-ethyl @ 60 g ha^{-1} + pretilachlor @ 300 g ha^{-1} and hence showed the highest weed control efficiency. Highest benefit-cost ratio (B:C)of 3.91 was realized with a combination of 90 kg N ha^{-1} and penoxsulam application @ 22.5 g ha^{-1}.

***Keywords*:** Basmati rice, chemical control, nitrogen and weed dynamics

Weeds pose a great threat to the crops by competing with the nutrients and other sources essential for the growth of a plant. Nitrogen is one of the most important components for crop-weed competitive interactions (Blackshaw *et al*., 2003). With the advancement of the chemical control of weeds it is now possible to get timely control of major weeds causing potential decline of the economic yield of crop. Henceforth, optimization of nitrogen and evaluation of the most efficient and economical herbicide is indispensable. It is important to understand weed responses to N rates for the development of strategies that reduce N availability to weeds (Liebman *et al.*, 1997). Nitrogen management significantly reduced the population of grasses, sedges and broad leaved weeds and led to an increase in weed control efficiency, growth attributes and yield of crop (Devi and Singh, 2018). Chauhan and Abugho (2013) reported that *E. crusgalli* growth and seed production increased with increases in N rate. Mahajan and Timsina (2011) found a strong linear relationship between increasing level of nitrogen and weed dry matter.

A prominent weed shift from grasses to non-grasses and annual sedges is being observed in transplanted rice due to continuous use of butachlor, pretilachlor, anilofos *etc*. All these herbicides have differential effects on weeds and are having narrow spectrum of controlling annual grasses. It has been observed that whenever there is an effective control of grasses due to these herbicides, annual sedges and broad leaved weeds emerge in high densities competing with the main crop which results in heavy economic loss (Singh *et al*., 2004). Moreover, continuous use of same herbicides with similar mode of action year after year may also result in weed flora shift towards more persistent perennials, development of herbicide resistance in weeds and buildup of herbicide residues in soil and consumable products (Kathiresan, 2001). Therefore, development and evaluation of new herbicides is of immense importance in order to widen the application window and weed control spectrum. New herbicides such as Eros (pretilachlor + pyrazosulfuron-ethyl) and penoxsulam have been observed to suppress at least the first flush of *Potamogeton* spp. Rinskor™ (florpyrauxifen-benzyl ester), a pyridine-2- carboxylate (or picolinate) auxin herbicide, shows broad-spectrum herbicidal activity and effectiveness against many dicot and monocot weed species. Italso exhibited excellent selectivity in rice (Epp *et al*., 2016).

Bhat *et al*. (2013) observed that penoxsulam @ 22.5 g ha^{-1} at 3 DAT gave lower weed density and weed dry matter in addition to higher weed control efficiency than standard butachlor @ 1500 g ha^{-1} and weedy check. Nath and Pandey (2013) recorded that application of penoxsulam @ 25 g ha^{-1}gave significantly lower weed population, dry weight and highest weed control efficiency except in hand weeding.

A field experiment was conducted at MRCFC, Khudwani on silty clay loam soil during *kharif* season of 2018 to study the response of basmati rice (Shalimar

Short communication
Email: romannissa876@gmail.com

Sugandh 1) to various nitrogen levels and pre / post emergence herbicides. The experiment was laid out in a factorial randomized block design (Factorial RBD) with 3 replications. Treatments comprised of three levels of nitrogen (0, 45 and 90 kg N ha^{-1}) and 3 herbicides (Florpyrauxifen-benzyl (Rinskor, W_1) @ 31.25 ml ha^{-1} and penoxsulam (Granite 240 SC, W_2) @ 22.5 g ha^{-1}, both applied as early post emergence herbicides at 10 DAT, pyrazosulfuron-ethyl @ 60 g ha^{-1} + pretilachlor @ 300 g ha^{-1} (Eros, W_3) applied as a pre-emergence herbicide at 3 DAT), in addition to weed free (W_4) and weedy check (W_5). Regular hand weeding was done at weekly intervals in weed free plot upto 45 DAT. The various weed parameters studied included: weed flora, weed density (no. m^{-2}), weed dry weight (g m^{-2}), weed control efficiency (%) and weed index.

Weed control efficiency (WCE) was worked outfor different weed control treatments as per the following formula (Gupta, 2016):

$$\text{WCE}\ (\%) = \frac{\text{Wc} - \text{Wt}}{\text{Wc}} \times 100$$

Where,

Wc = Weed dry weight in control plot

Wt = Weed dry weight in treated plot

Weed index (WI) for different weed control treatments was worked as per the following formula (Gupta, 2016):

$$\text{WI}\ (\%) = \frac{\text{YHW} - \text{Y}}{\text{YHW}} \times 100$$

Where,

YHW = average crop yield in hand weeded plot

Y= average crop yield in treated plot

The experimental field was over taken by grassy, broad leaved weeds and sedges in the ratio of 10.0, 40.0 and 50.0%, respectively. Treatments with higher nitrogen levels recorded higher percentage of weed flora. The prominent weed flora observed in the experimental field is mentioned in the table 1.

Effects of nitrogen levels

The data with respect to weed population as affected by various treatments is presented in the table 2. Nitrogen levels recorded a non-significant effect on weed densities both at 25 and 45 DAT, however, more number of weeds were recorded in treatments that received nitrogen @ 90 kg ha^{-1}.

Nitrogen levels significantly influenced the weed dry matter both at 25 and 45 DAT (Table 2). Weed dry matter was significantly reduced under control (N_1) level over application of 45 kg N ha^{-1} (N_2) and 90 kg N ha^{-1} (N_3) both at 25 and 45 DAT.On an average, superiority exhibited by N_1 (control) in reducing the weed dry matter over N_2 and N_3 was 20.4 and 31.6 per cent, respectively.The lower dry matter of weeds in no N plots (N_1) may be due to frequent killing of weeds by starvation for nitrogen and higher weed dry matter in higher N plots could be because of more nutrition in those plots for weed growth and abundance. The results are in conformity with those of Devi and Singh (2018) and Mahajan and Timsina (2011).

Non-significant effects were recorded by different N levels on weed index (Table 2). However, application of 90 kg N ha^{-1} (N_3) recorded lower weed index (3.19) while as application of 45 kg N ha^{-1} (N_2) and control (N_1) recorded weed index of 3.67 and 3.73, respectively. This can be due to higher yields in higher N fertilizer plots due to higher uptake of nutrients, higher dry matter accumulation and due to the favourable effects of other growth contributing factors.

Effect of weed management practices

All the weed management practices had a significant effect on weed density. Application of penoxsulam @ 22.5 g ha^{-1} (W_2) recorded significantly lower weed population, both at 25 and 45 DAT, respectively, over weedy check and other herbicidal treatments (Table 2). Application of pyrazosulfuron-ethyl @ 60 g ha^{-1} + pretilachlor @ 300 g ha^{-1} (W_3) in turn proved significantly superior in recording lower weed densities as against W_1 and weedy check. Application of florpyrauxifen-benzyl @ 31.25 ml ha^{-1} (W_1) was also significantly superior in recording lesser weeds as compared to weedy check, both at 25 and 45 DAT. The magnitude of superiority exhibited by different weed control treatments was of the order $W_2 > W_3 > W_1$. The superiority exhibited by the application of W_2 over W_5 at 25 and 45 DAT was 75.5 and 69.1 per cent, respectively. This is on account of better reduction in weed population by penoxsulum in comparison to other weed control options. Similar findings were also made by Duy *et al*. (2018), Ganai *et al*. (2018), Bhat *et al*. (2013).

All the weed management practices significantly reduced weed dry matter over unweeded control, both at 25 and 45 DAT (Table 2). Application of penoxsulam @ 22.5 g ha^{-1} significantly reduced the weed dry matter over weedy check and other herbicidal treatments both at 25 and 45 DAT. On an average, reduction in weed dry matter at 25 and 45 DAT by the application of penoxsulam @ 22.5 g ha^{-1} (W_2) over weedy check (W_5) was 81.4 and 72.1 per cent, respectively. It can be due to the fact that weeds were very efficiently eradicated by penoxsulum. Results are in line with those of Ganai *et al*. (2018), Bhat *et al*. (2017).

Table 1: Dominant weed flora identified during experimentationin rice field

Scientific name	Common name	Family
Grasses		
Echinochloa crusgalli	Barnyard grass	Poaceae
Echinochloa colona	Jungle grass	Poaceae
Sedges		
Cyperusiria	Rice flat sedge	Cyperaceae
C. difformis	Rice sedge	Cyperaceae
Fimbristylis spp.	Fimbry	Cyperaceae
Scirpus spp.	Club-rush	Cyperaceae
Broad leaved weeds		
Ammania baccifera	Monarch redstem	Lythraceae
Marsilea quadrifolia	Four leaf clover	Marsileaceae
Potamogeton distinctus	Pondweed	Potamogetonaceae
Eclipta alba	False daisy	Asteraceae
Polygonum spp.	Knotweed	Polygonaceae
Monochoria vaginalis	Oval leaf pond weed	Ponteriaceae
Rotala indica	Indian toothcup	Lythraceae

Table 2: Effect of nitrogen levels and weed management practices on weed density, weed dry matter , weed control efficiency and weed index in Basmati rice (Shalimar Sugandh1)

Treatments	Weed density (No. m^{-2})		Weed dry matter (g m^{-2})		Weed control efficiency (%)		Weed index (%)
	25 DAT	45 DAT	25 DAT	45 DAT	25 DAT	45 DAT	
Nitrogen levels							
N_1	4.07 (19.07)	5.25 (32.73)	2.89 (9.17)	4.22 (21.12)	-	-	3.73 (17.60)
N_2	4.12 (19.73)	5.32 (33.60)	3.10 (10.75)	4.81 (27.31)	-	-	3.67 (16.38)
N_3	4.24 (20.87)	5.52 (35.87)	3.34 (12.63)	5.20 (31.68)	-	-	3.19 (12.81)
SEm (±)	**0.11**	**0.10**	**0.600**	**0.081**	-	-	**0.203**
LSD (0.05)	**NS**	**NS**	**0.17**	**0.24**	-	-	**NS**
Weed management practices							
W_1	5.13 (25.56)	6.83 (45.78)	3.95 (14.77)	5.75 (32.35)	6.83 (45.90)	6.71 (45.09)	4.36 (19.26)
W_2	3.41 (10.78)	4.73 (21.44)	2.46 (5.09)	4.15 (16.74)	9.07 (81.30)	8.56 (72.43)	2.24 (4.21)
W_3	4.45 (19.00)	5.88 (33.78)	2.82 (7.03)	5.02 (24.48)	8.66 (74.16)	7.76 (59.31)	3.32 (11.68)
W_4	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	10.05 (100.00)	10.05 (100.00)	1.00 (0.00)
W_5	6.71 (44.11)	8.38 (69.33)	5.31 (27.36)	7.79 (59.96)	1.00 (0.00)	1.00 (0.00)	6.58 (42.83)
SEm (±)	**0.14**	**0.12**	**0.077**	**0.105**	**0.186**	**0.105**	**0.262**
LSD (0.05)	**0.41**	**0.36**	**0.22**	**0.30**	**0.54**	**0.30**	**0.76**
N × W	**NS**	**NS**	**NS**	**0.53**	-	-	-

Note: Figures in parenthesis are original values, data subjected to “x+1 transformation; DAT: Days after transplanting; NS: Non-significant

Table 3: Interaction between N and weed management practices on weed dry matter (g m^{-2}) at 45 DAT

Treatments	N_1	N_2	N_3	Mean
W_1	5.170	5.817	6.258	5.748
	(25.90)	(32.84)	(38.30)	(32.35)
W_2	3.372	4.177	4.927	4.159
	(10.37)	(16.48)	(23.36)	(16.74)
W_3	4.350	5.088	5.618	5.019
	(17.95)	(24.90)	(30.59)	(24.48)
W_4	1.000	1.000	1.000	1.000
	(0.00)	(0.00)	(0.00)	(0.00)
W_5	7.218	7.945	8.194	7.786
	(51.39)	(62.33)	(66.16)	(59.96)
Mean	4.222	4.805	5.200	-
	(21.12)	(27.31)	(31.68)	
LSD (0.05)		**N ×W = 0.53**		

Note: W_1: Florpyrauxifen-benzyl; W_2: Penoxsulam; W_3: Pyrazosulfuron-ethyl+ Pretilachlor; W_4: Weed free; W_5: Weedy check

The interaction between nitrogen levels and weed management practices in reducing weed dry matter was significant at 45 DAT (Table 3). The combination of N_1- and application of penoxsulam @ 22.5 g ha^{-1} recorded significant interaction in reducing the dry matter of weeds at 45 DAT followed by N_2 and N_3 with same herbicide treatment. This can be due to the better efficacy of penoxsulum in addition to less nitrogen application which could have resulted in lesser growth and development of weeds. Similar results were recorded by Ganai *et al.* (2018).

Apart from weed free treatment which recorded 100 per cent weed control efficiency, application of penoxsulam @ 22.5 g ha^{-1} (W_2) proved significantly better measure for recording higher weed control efficiency in view of its efficiency in reducing the growth of weeds at all growth stages (Table 2). However, application of penoxsulam @ 22.5 g ha^{-1} (W_2) was at par with the application of pyrazosulfuron-ethyl @ 60 g ha^{-1} + pretilachlor @ 300 g ha^{-1} (W_3) at 25 DAT. This could be attributed due to reduction of weed biomass on account of effective weed control measures adopted and thus resulted in higher weed control efficiency. At 25 and 45 DAT, application of penoxsulam @ 22.5 g ha^{-1} recorded 81.3 and 72.4 per cent weed control efficiency followed by application of pyrazosulfuron-ethyl @ 60 g ha^{-1} + pretilachlor @ 300 g ha^{-1} (W_3) (74.2 and 59.3, respectively). The results are in close conformity with those of Ganai *et al*. (2018), Singh (2016).

Weed control treatments caused significant variation on weed index in transplanted scented rice (Table 2). Among the weed management practices, application of penoxsulam @ 22.5 g ha^{-1} (W_2) recorded significantly minimum weed index (2.24) followed by application of pyrazosulfuron-ethyl @ 60 g ha^{-1} + pretilachlor @ 300 g ha^{-1}(W_3) and florpyrauxifen-benzyl @ 31.25 ml ha^{-1} (W_1) (3.32 & 4.36), respectively.

The data further revealed that the loss in grain yield of rice due to weedy check was (42.8 %) and minimum reduction in grain yield due to application of penoxsulam @ 22.5 g ha^{-1} (W_2) was 4.21 per cent followed by application of pyrazosulfuron-ethyl @ 60 g ha^{-1} + pretilachlor @ 300 g ha^{-1} (W_3) (11.7 %), respectively. This may be due to lower weed densities and resulted in increased uptake of nutrients by the crop and thus increased grain yield. The results are in line with those of Singh (2016), Bhat *et al*. (2013).

Highest net returns of Rs. 192814 ha^{-1} and benefit-cost ratio of (3.91) was obtained under N_3W_2 (90 kg N ha^{-1} + penoxsulam @ 22.5 g ha^{-1}) followed by the N_3W_3 (3.85) i.e., application of 90 kg N ha^{-1} + pyrazosulfuron-ethyl @ 60 g ha^{-1} + pretilachlor @ 300 g ha^{-1}). This might be due to higher yield and lower cost of cultivation in these treatments. The results are in line with those of Ganai *et al.* (2018), Bhat *et al*. (2013).

Treatment N_3W_2 (90 kg N ha^{-1} + penoxsulam @ 22.5 g ha^{-1}) emerged as a superior treatment because both highest B:C ratio and significant decrease in weed dry weight and weed density at various crop growth stages over other weed management practices was realised with this combination.

REFERENCES

Bhat, M.A., Ashaq, H., Ganai, M.A. and Teli, N.A. 2013. Efficacy of penoxsulam against weeds in transplanted rice (*Oryza sativa* L.) under temperate conditions of Kashmir. *Appl. Biol. Res.,* **15**(2) : 145-148.

Bhat, M.A., Hussain, A., Ganai, M.A., Jehangir, I.A. and Teli, N.A. 2017. Bioefficacy of pyrazosulfuron and bensulfuron methyl in combination with pretilachlor against weeds in transplanted rice (*Oryza sativa* L.) under temperate conditions of Kashmir. *J. Crop and Weed,* **13**(1) : 178-182.

Blackshaw, R.E., Brandt, R.N., Janzen, H.H., Entz, T., Grant, C.A. and Derksen, D.A. 2003. Differential response of weed species to added nitrogen. *Weed Sci*., **51**(4) : 532-539.

Chauhan, B.S. and Abugho, S.B. 2013. Effects of water regime, nitrogen fertilization, and rice plant density on growth and reproduction of lowland weed *Echinochloa crusgalli*. *Crop Protec.,* **54**: 142-147.

Devi, B.R. and Singh, Y. 2018. Influence of nitrogen and weed management practices on growth and yield of direct seeded rice (*Oryza sativa* L.). *Int. J. Curr. Microbiol. Appl. Sci.,* **7**(1) : 2566-2574.

Duy, L., Chon, N.M., Mann, R.K., Kumar, B.V. and Morell, M.A. 2018. Efficacy of Rinskor™ (florpyrauxifen-benzyl ester) on herbicide resistant barnyard grass (*Echinochloa crusgalli*) in rice fields of Mekong Delta, Vietnam. *J. Crop Sci. Biotechnol.,* **21**(1) : 75-81.

Epp, J.B., Alexander, A.L., Balko, T.W., Buysse, A.M., Brewster, W.K., Bryan, K., Daeuble, J.F., Fields, S.C., Gast, R.E., Green, R.A. and Irvine, N.M. 2016. The discovery of Arylex™ active and Rinskor™ active: two novel auxin herbicides. *Bioorganic & Medicinal Chem.,* **24**(3) : 362-371.

Ganai, M.A., Panotra, N., Hussian, A., Telli, N.A., Hussian, T. and Ahmad, T. 2018. Influence of water regimes and weed management practices on weed densities and weed growth under system of rice intensification (SRI) under temperate conditions. *Int. J. Agric. Environ. Biotechnol.,* **11**(1) : 1-9.

Gupta, O.P. 2016. *Modern Weed Management*. AGROBIOS. Jodhpur, pp. 500.

Kathiresan, R.M. 2001. Sustainability of weed management practices in rice-black gram cropping system. In. *Eco-Friendly Weed Management Options for Sustainable Agriculture*, Lead paper and Abstract of Final Biennial Conference in the New Millennium, University of Agricultural Sciences, Bangalore, India, pp. 79.

Liebman, M., Gallandt, E.R. and Jackson, L.E. 1997. Many little hammers: ecological management of crop-weed interactions. *Ecol. Agric.,* **1** : 291-343.

Mahajan, G. and Timsina, J. 2011. Effect of nitrogen rates and weed control methods on weeds abundance and yield of direct-seeded rice. *Arch. Agron. Soil Sci.,* **57**(3):239-250. DOI: 10.1080/03650340903369384.

Nath, C.P. and Pandey, P.C. 2013. Evaluation of herbicides on grain yield and nutrient uptake in rice (*Oryza sativa* L.). *BIOINFOLET-A Quart. J. Life Sci.,* **10**(1b) : 282-287.

Singh, P.S. 2016. Studies on bio-efficacy of herbicide on weed growth, yield and economics of direct seeded rice (*Oryza sativa* L.) varieties. Doctoral dissertation, Indira Gandhi Krishi Vishwavidyalaya, Raipur.

Singh, V.P., Govindra, S. and Mahendra, S. 2004. Effect of fenoxaprop-p-ethyl on transplanted rice and associated weeds. *Indian J. Weed Sci.,* **36**(3&4) : 190-192.