Plant Archives Vol. 16 No. 1, 2016 pp. 261-265 ***ISSN 0972-5210***

EFFECT OF SEED RATE AND WEED MANAGEMENT PRACTICES ON WEED DYNAMICS AND NUTRIENT REMOVAL BY WEEDS

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Abstract

An experiment was conducted at Crop Research Center of Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh, India during winter seasons of 2012-13 and 2013-14 to assess the effect of seed rate and weed management practices on weeds and productivity of late sown wheat (*Triticum aestivum* L.) sowing with 150 kg ha^{-1} seed rate recorded minimum density and dry weight of weeds, which was significantly lower than 100 and 125 kg ha^{-1} seed rate. The minimum NPK content and uptake by weeds with 150 kg ha^{-1} seed rate was lower than 100 and 125 kg ha^{-1} seed rate, while N.P.K. content and uptake was maximum with 100 kg ha^{-1} seed rate. Among weed management practices minimum weed density, which was at par with Clodinafop + Metsulfuron (60 + 4 g ha^{-1}), Fenoxaprop-p-ethyl + Metribuzin (120 + 210 g ha^{-1}) and significantly lower than Sulfosulfuron + Metsulfuron (30 + 2 g ha^{-1}), Sulfosulfuron 25 g ha^{-1} and weedy check was recorded with two hand weeding. Minimum dry matter with two hand weeding was at par with Clodinafop + Metsulfuron (60 + 4 g ha^{-1}), Fenoxaprop-p-ethyl + Metribuzin (120 + 210 g ha^{-1}) and significantly lower than Sulfosulfuron + Metsulfuron (30 + 2 g ha^{-1}), Sulfosulfuron 25 g ha^{-1} and weedy check. Maximum NPK content and removal was recorded with weedy check, while minimum with two hand weeding which was at par with Clodinafop + Metsulfuron (60 + 4 g ha^{-1}), Fenoxaprop-p-ethyl + Metribuzin (120 + 210 g ha^{-1}) and Sulfosulfuron + Metsulfuron (30 + 2 g ha^{-1}) and significantly lower than Sulfosulfuron 25 g ha^{-1} and weedy check.

Key words : Seed rate, herbicide, wheat, weeds dry weight, nutrient content & uptake.

Introduction

Wheat is an important prime cereal crop among the food-grain is grown in an area of 29.65 m ha in India, with the production 93.5 million tonnes and average productivity 31.53 q ha^{-1} (FAO, 2013). Among several causes of low productivity in Uttar Pradesh, adoption of rice-wheat rotation is one. Late transplanting of rice or use of long duration varieties in low land fields delays the sowing of wheat. The preceding crop like sugarcane, potato, paddy and toria etc. vacate the field late in season after normal sowing date of wheat and other factors enforce the crop be sown as much late as in the end of December and beginning of January. Late sown crop experiences high temperature, declining relative humidity and hot dissecting winds in later stage of crop growth, particularly during grain filling stage. Yield potential and productivity of wheat under late sown condition is poor due to less exploitation of potentialities of the crop. Emergence of seedling due to low temperature curtailing the periods from emergence to maturity in late sown condition optimum plant population can be maintain by optimum seed rate (Singh and Singh, 1987). Late sowing of wheat tends to reduce germination count due to low temperature at germination and tillers unit^{-1} area because of rise in temperature during tillering phase of the crop and consequently increase in the temperature at milking stage of the crop is the major threat affecting the productivity adversely. To mitigate the deleterious effect of delayed sowing, increasing seed rate will be a viable and economic option to compensate the reduction germination count and number of tillers per unit area.

Weeds are also considered as major constraints in wheat cultivation under late sown condition. Increasing population of canary grass (*Phalaris minor* Retz.) with broad leaf weeds causing substantial yield loss in rice-wheat cropping system, yield reduction due to weeds is 38-42% (Bharat and Kachroo, 2007) or even more. Due to severe infestation of *Phalaris minor* significant reduction in wheat yield ranging from 18-73% has been reported by Pandey and Verma (2004). With the introduction of high yielding dwarf varieties having heavy demand of inputs, the problem of weed infestation has increased manifold, as it created favourable condition for invasion as well as luxuriant growth of weeds, particularly *Phalaris minor*. Weeds infestation in wheat is rampant and caused depletion of 31 kg N, 16 kg P and 29 kg K ha^{-1} from wheat crop field (Pandey *et al.*, 2007) and considerable amount of secondary and micro-nutrients, thereby resulting in heavy yield reduction. Commonly used herbicides Isoproturon and Sulfosulfuron control grassy weeds only, but had little effect or troublesome broad-leaf weeds. Further continuous use of Isoproturon caused development of resistant biotypes of *Phalaris minor* (Malik and Singh, 1995). To overcome these problem farmers are applying more nutrients and different brands of the herbicides alone or in combination to eliminate the weeds, but such practices lack proper scientific evidences. Hence, it is essential to identify alternate herbicide molecules with broad spectrum activity or their combination of available herbicides for sustainable weed management in wheat. Keeping these facts in view, the present investigation was under taken to study the effect of seed rate and weed management practices on weeds and productivity of late sown wheat.

Materials and Methods

A field experiment was conducted during *rabi* seasons of 2012-13 and 2013-14 at Crop Research Center of Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh (India), belong to North Western Plain Zone in irrigated ecosystem. Soil was sandy loam in texture having pH 7.81 and 8.21, organic carbon 0.43-0.41% and available NPK was 178.6 and 175; 17.4 and 16.5; 25.5 and 250.4 kg ha^{-1} during 2012-13 and 2013-14, respectively. The treatment comprised of three seed rates (100, 125 and 150 kg ha^{-1}) in main plots and five weed management practices, *viz*. Sulfosulfuron 25 g ha^{-1}, Sulfosulfuron + Metsulfuron (30

Table 1 : Density of total weeds (number m^{-2}) as influenced by different seed rate and weed management practices.

Treatment	30 DAS		60 DAS		90 DAS	
	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14
Seed rate						
100 Kg ha^{-1}	11.86 (139.72)	11.84 (139.22)	6.18 (38.21)	6.28 (38.39)	5.77 (32.28)	5.92 (34.00)
125 Kg ha^{-1}	11.10 (122.11)	10.95 (118.94)	5.82 (32.83)	5.76 (32.22)	5.27 (26.80)	5.43 (28.44)
150 Kg ha^{-1}	10.07 (100.39)	9.94 (97.89)	5.33 (27.50)	5.22 (26.28)	4.90 (23.00)	4.95 (23.50)
S.Em. (±)	0.05	0.04	0.03	0.04	0.04	0.04
C.D. (P=0.05)	0.22	0.17	0.14	0.17	0.14	0.16
Weed management practices						
Sulfosulfuron (25 g ha^{-1})	11.72 (136.47)	11.74 (136.87)	6.31 (38.78)	6.19 (37.33)	5.37 (27.89)	5.41 (28.22)
Sulfosulfuron+Metsulfuron (30 g + 2 g ha^{-1})	11.65 (134.78)	11.56 (132.67)	4.12 (16.00)	3.93 (14.44)	3.38 (10.45)	3.46 (11.00)
Clodinafop+Metsulfuron (60 g + 4 g ha^{-1})	11.53 (132.11)	11.49 (131.11)	3.00 (8.00)	2.96 (7.78)	2.83 (7.00)	2.87 (7.22)
Fenoxaprop + Metribuzin (120 g + 210 g ha^{-1})	11.70 (135.89)	11.50 (131.45)	3.21 (9.33)	3.25 (9.55)	3.11 (8.67)	3.09 (8.56)
Two hand weeding (20 & 40 DAS)	7.02 (48.33)	6.95 (47.33)	2.90 (7.44)	2.90 (7.40)	2.71 (6.33)	2.73 (6.43)
Weedy check	11.73 (136.67)	11.57 (132.89)	10.92 (118.22)	10.88 (117.45)	10.25 (104.22)	10.47 (108.67)
S.Em. (±)	0.17	0.16	0.12	0.12	0.14	0.13
C.D. (P = 0.05)	0.49	0.45	0.35	0.34	0.42	0.38

Original values is parentheses and data subjected to square root ($\sqrt{x+1}$) transformation.

Table 2 : Dry matter accumulation (g m^{-2}) of total weeds as influenced by different seed rate and weed management practices.

Treatment	30 DAS		60 DAS		90 DAS	
	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14
Seed rate						
100 Kg ha^{-1}	5.01 (24.14)	5.10 (25.05)	5.19 (25.92)	5.34 (27.51)	6.62 (42.78)	6.79 (45.17)
125 Kg ha^{-1}	4.76 (21.62)	4.76 (21.62)	4.93 (23.26)	5.00 (24.01)	5.28 (38.41)	6.37 (39.65)
150 Kg ha^{-1}	4.48 (19.20)	4.51 (19.35)	4.65 (20.65)	4.63 (21.46)	5.91 (33.96)	6.06 (35.77)
S.Em. (±)	0.05	0.06	0.05	0.04	0.04	0.05
C.D. (P = 0.05)	0.19	0.24	0.20	0.18	0.17	0.20
Weed management practices						
Sulfosulfuron (25 g ha^{-1})	5.03 (24.33)	5.05 (24.53)	5.03 (24.30)	5.17 (25.74)	6.40 (39.97)	6.47 (40.89)
Sulfosulfuron+Metsulfuron (30 g + 2 g ha^{-1})	5.00 (24.00)	5.03 (24.32)	3.37 (10.38)	3.48 (11.08)	3.76 (13.20)	3.80 (13.48)
Clodinafop+Metsulfuron (60 g + 4 g ha^{-1})	4.97 (23.71)	5.03 (24.31)	2.91 (7.52)	2.94 (7.63)	3.01 (8.09)	3.00 (8.01)
Fenoxaprop+ Metribuzin (120 g + 210 g ha^{-1})	5.00 (24.07)	5.01 (24.12)	3.15 (8.97)	3.32 (10.02)	3.33 (10.11)	3.44 (10.83)
Two hand weeding (20 & 40 DAS)	3.23 (9.46)	3.28 (9.76)	2.88 (7.30)	2.91 (7.48)	2.99 (7.96)	2.97 (7.82)
Weedy check	5.01 (24.15)	5.05 (24.54)	9.06 (81.10)	9.22 (84.09)	12.33 (150.97)	12.69 (160.16)
S.Em. (±)	0.17	0.16	0.11	0.15	0.12	0.17
C.D. (P=0.05)	0.48	0.46	0.33	0.44	0.35	0.49

Original values is parentheses and data subjected to square root ($\sqrt{x+1}$) transformation.

+ 2 g ha^{-1}), Clodinafop + Metsulfuron (60 + 4 g ha^{-1}), Fenoxaprop-p-ethyl + Metribuzin (120 + 210 g ha^{-1}), two hand weeding (120 and 40 DAS) and weedy check in subplots. The experiment was laid out in split plot design with three replications. A promising wheat variety PBW-590 recommended for late sown condition for NWPZ of wheat was sown on 08 and 09 December during 2012-13 and 2013-14, respectively. A uniform dose of 120 kg N, 60 kg P and 40 kg K ha^{-1} was applied in the form of Urea, Di-ammonium phosphate and Muriate of potash in all the plots. One-third dose of nitrogen and full dose of phosphorus and potassium was applied as basal and remaining two-thirds of nitrogen was applied through urea as top dressing after first irrigation and panicle initiation stages. First irrigation was given at crown root initial stage after that crop was irrigated 20-25 days interval to avoid any kind of water stress. Herbicides were applied as post emergence *i.e.* 30 DAS with the help of hand-operated Knapsack sprayer, fitted with flat fan nozzle with 250 litter ha^{-1} water. First hand weeding was done at 20 and second at 40 DAS. Weed density and dry weight was recorded at 30, 60 and 90 DAS and NPK content and uptake of weeds was estimated at 60 DAS. The data recorded on weed density and dry weight was subjected to square root transformation before statically analysis.

Results and Discussion

The important weed flora infesting the crop field were *Phalaris minor*, *Chenopodium album*, *Anagallis arvensis, Melitotus indica* and other weeds like *Avena fatua*, *Cynodon dactylon*, *Fumaria parviflora*, *Coronopus didymus*, *Rumex dentatus* and *Cyprus rotundus*. Density and dry weight of weeds was significantly influenced by different seed rate during both the years. Data reveal that increasing seed rate from

Table 3 : Effect of seed rate and weed management practices on N, P, K content (%) and uptake (kg ha^{-1}) by weeds at 60 days.

Treatment	Content (%)						Uptake (kg ha^{-1})					
	Nitrogen		Phosphorus		Potassium		Nitrogen		Phosphorus		Potassium	
	2012 -13	2013 -14	2012 -13	2013 -14	2012 -13	2013 -14	2012 -13	2013 -14	201 -13	2013 -14	2012 -13	2013 -14
Seed rate												
100 kg ha^{-1}	1.730	1.753	0.198	0.211	1.278	1.297	4.51	4.85	0.55	0.60	3.34	3.57
125 kg ha $^{-1}$	1.719	1.736	0.190	0.199	1.249	1.286	4.02	4.20	0.47	0.49	2.94	3.12
150 kg ha^{-1}	1.658	1.712	1.870	0.190	1.239	1.278	3.46	3.70	0.40	0.42	2.60	2.78
SEm(±)	0.017	0.017	0.004	0.005	0.010	0.009	0.16	0.10	0.06	0.06	0.11	0.13
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	0.62	0.39	NS	NS	0.45	0.53
Weed management practices												
Sulfosulfuron (25 g ha^{-1})	1.703	1.742	0.199	0.209	1.273	1.308	4.15	4.492	0.49	0.54	3.10	3.37
Sulfosulfuron Metsulfuron (30 g +2 g ha^{-1})	1.703	1.737	0.193	0.204	1.259	1.294	1.77	1.931	0.20	0.23	1.31	1.44
Clodinafop+ Metsulfuron (60 g + 4 g ha^{-1})	1.710	1.729	0.188	0.194	1.244	1.273	1.29	1.322	0.14	0.15	0.94	0.97
Fenoxaprop + Metribuzin (120 g + 210 g ha^{-1})	1.676	1.711	0.178	0.194	1.239	1.274	1.51	1.714	0.16	0.20	1.11	1.28
Two hand weeding (20 & 40 DAS)	1.704	1.731	0.183	0.190	1.239	1.267	1.26	1.283	0.14	0.14	0.92	0.94
Weedy check	1.717	1.75	0.209	0.208	1.277	1.304	13.95	14.76	1.71	1.75	10.36	10.95
SEm(±)	0.049	0.049	0.014	0.015	0.036	0.034	0.21	0.10	0.07	0.06	0.15	0.15
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	0.61	0.39	0.19	0.19	0.45	0.44

NS– Non-significant.

100 to 150 kg ha^{-1} decrease the density and dry weight of total weeds at all stages of crop growth during both the years. Sowing with 150 kg ha^{-1} seed rate recorded minimum density and dry weight of total weeds, which was significantly lower than 100 and 125 kg ha^{-1} seed rate. Sowing with 150 kg ha^{-1} seed rate reduced dry weight of weeds significantly by 20.6 and 11.57 per cent during 2012-13 and 20.81 and 9.97 per cent during 2013-14 over the 100 and 125 kg ha^{-1} seed rate (tables 1 & 2). This might be due to suppressive effect of higher plant population on weed growth with higher seed rate *i.e*. 150 kg ha^{-1}. Similar result has also been reported by Bhan *et al*. (1987), Panwar *et al*. (1989), Bibi *et al*. (2008). All weed management practices had significant effect on density and dry weight of weeds. At 30 DAS two hand weeding recorded minimum density and dry weight of weeds, which was significantly lower than rest of the weed management practices. At 60 and 90 DAS two hand weeding recorded the density of weeds to minimum, which was at par with Clodinafop + Metsulfuron (60 + 4 g ha^{-1}) and Fenoxaprop-p-ethyl + Metribuzin (120 + 210 g ha^{-1}) and significantly lower than rest of the weed management practices. Dry weight of weeds was also recorded minimum with two hand weeding which was at par with Clodinafop + Metsulfuron (60 + 4 g ha^{-1}) and significantly lower than rest of the weed management practices during both years. This finding is an agreement with finding of Bibi *et al*. (2008) and Tomar and Tomar (2014). The lowest NPK content in weeds was recorded at 150 kg ha^{-1} seed rate and maximum content at100 kg ha^{-1} but difference was non-significant in respect of NPK content in weeds. NPK removal by weeds was maximum at 100 kg ha^{-1} seed rate (table 3). This might be due to higher weed dry weight and less plant population at 100 kg ha^{-1}, therefore, more space available for growth of weeds. Similar results reported by Sharma and Singh (2011). All weed management practices had non-significant effect for NPK content whereas removal by weeds was affected significantly. Maximum NPK removal recorded with weedy check, while minimum

NPK with two hand weeding, which was at par with Clodinafop + Metsulfuron (60 + 4 g ha^{-1}), Fenoxaprop-p-ethyl + Metribuzin (120 + 210 g ha^{-1}) and Sulfosulfuron + Metsulfuron (30+2 g ha^{-1}). Similer results was also reported by Tomar and Tomar (2014).

Summary and Conclusion

Based on two year experiment conducted at Crop Research Centre of Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (U.P.), India. It may be concluded that sowing with 150 kg ha^{-1} seed rate and application of herbicide Clodinafop + Metsulfuron (60 + 4 g ha^{-1}) effectively resulted in reduction weed density, dry matter accumulation and NPK removal by weeds. Therefore, crop may be sown with 150 kg ha^{-1} seed rate and Clodinafop + Metsulfuron (60 + 4 g ha^{-1}) for effective control of density, dry weight and nutrient removal by weeds.

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