Original Research Article

Effect of different dose of herbicide on soil physico-chemical and biological properties after harvest of wheat

Abstract

A field experiment conducted at Agricultural Research Farm, Division of Agronomy, BHU, Varanasi to evaluate the efficacy of herbicide to control of weeds in wheat crop. In the experimental field weeds were controlled by pre-emergence application of herbicides *viz.*,pendimethalin 30% EC @ 600 g ha^{-1}, pendimethalin 30% EC @ 900 g ha^{-1}, pendimethalin 30% EC @ 1200 g ha^{-1}, pendimethalin 30% EC @ 1500 g ha^{-1}, metribuzin 70% WP @ 210 g ha^{-1} weed free (two hands weeding) and Untreated Control (Weedy check). Effect of treatments on soil physico-chemical properties like soil bulk density, soil pH, electric conductivity and organic carbon are not significance variation among the treatments. The available nitrogen in soil after harvest of wheat was more under hand weeded treated plots which was statistically comparable with application of pendimethalin 30% EC @ 900 g ha^{-1} over the rest of the treatments. However, available phosphorus and potassium in non-significant it does not influenced by the treatments.

Key words – Chemical, Metribuzin, Pendimethalin, Weed, Wheat.

INTRODUCTION

Wheat is important staple crop and dominant crop in temperate countries. Wheat is heavily infested with narrow leaf weed and broad leaf weed. Wheat is mainly infested with *Solanum nigrum, Anagallis arvensis, Chenopodium album, Vicia sativa, Melilotus indicus, Rumex dentatus,Medicago denticulatum, Cynodondactylon, Phalaris minor* and *Cyperus rotundus.* The yield losses caused by weeds alone account 10 to 80% reduces depending upon weed species, severity and duration of weed infestation in which *Phalaris minor* and *Avena ludoviciana* are major problematic grass weeds causing large scale reductions in wheat grain yield Banerjee *et al.*(2019). In North-West India, continuous use of isoproturon particularly in rice-wheat cropping system evolved multiple resistance in *Phalaris minor* due to shifting of weed flora which is a major reason for yield loss in wheat crop Kaur *et al.* (2019). Several herbicides used in crop in which herbicide is effective only one weed species is generally ineffective against other weed species. Continuous use of similar mode of action of herbicide overcome the weed infestation caused threating to sustainability of crop. Repeated use of same herbicide cause herbicide resistance which is very critical problem now days. More chemicals applied on the crop directly and indirectly reduce the soil fertility and various nutrient will imbalance in this way the biological life present in the soil is also affected. Herbicide is also one type of chemical that affect the plant and soil health. This chemicals have residual effect on the succeeding crop. This toxic chemicals present almost many year ago in the soil that cause the danger effect that growing in the same field crop.

MATERIAL AND METHODS

Field trial was carried out at Agricultural Research Farm of Banaras Hindu University, Varanasi, Uttar Pradesh during *Rabi* season of 2018-2019. The farm is situated at sub- tropical zone of Indo-Gangetic plains on 25^0 18' North latitude and 83^0 03' longitude and at an altitude of 75.70 meter above mean sea level. The composite soil sample was collected at 0-15 cm depth randomly from experimental area before conducting experiment procedure and after harvest, again taken soil sample for analysed its physico- chemical properties in lab for each experiment plot. It is conducted for estimation of available nitrogen, phosphorus and potassium content in the soil. The soil was sandy clay loam type (Inceptisol), pH is 7.4, low EC (dS m^{-1}) is 0.32,low in organic carbon 0.34%, and in available nitrogen 185 kg N/ha, medium in available phosphorus 22.3 kg P_2O_5 ha^{-1} and potassium178 kg K_2O ha^{-1}. The experiment was laid out in randomized complete block design with three replications having 5.5 x 4.5 m plot sizes. Seven treatments were evaluated in randomized block design with three replications. The treatments comprised of their doses of Pendimethalin 30% EC 600 g ha^{-1}, 900 g ha^{-1}, 1200 g ha^{-1}, 1500 g ha^{-1} and Metribuzin 70% WP as well as two hand weeding at 20 and 40 days after sowing (DAS) and untreated plot. The wheat variety "*HD 2967*" was sown on 6 December 2018 by using seed rate 100 kg ha^{-1} with the help of *kudal* by maintaining 22.5 cm row spacing. The data on weed density was recorded from four randomly selected spots for each plot at 60 days after sowing (DAS) using 0.5 × 0.5 m quadrat. Weed biomass was recorded at 60 days after spray by cutting the weed plants above the ground by randomly placing the four quadrats of 0.5 × 0.5 m and then the samples were oven dried at 70°C until they reached to a constant weight. The pre-emergence herbicides were sprayed on the next day of sowing using 500 litre water/ha using knapsack sprayer fitted with flan-fan nozzle.

RESULT and DISCUSSION

Effect on soil physico chemical properties

The observation recorded after the lab analysis of soil like pH 7.64 is maximum at application of pendimethalin 30% EC @ 1200 g ha^{-1} and minimum at application of metribuzin 70% WP @ 210 g ha^{-1} is 7.04. Bulk density of soil is highest with at control plot is 1.45 Mg/m^3 and lowest BD is 1.40 Mg/m^3 observed with pendimethalin 30% EC @ 1200 g ha^{-1}. After harvest of crop electrical conductivity is maxium at untreated plot and pendimethalin 30% EC @ 1500 g ha^{-1} is 0.34 dS/m and minimum EC is 0.30 dS/m obtained at application of pendimethalin 30% EC @ 1200 g ha^{-1} and hand weeded plot. Organic carbon is highest observed with pendimethalin 30% EC @ 1200 g ha^{-1} is 0.37% and lowest 0.33% observed at hand weeded plot. The highest available nitrogen in soil after harvest of wheat hand weeded plot is 116.34 kg ha^{-1} and lowest nitrogen available with untreated plot is 116.34 kg ha^{-1}. The available phosphorus in soil is highest observed with hand weeded treated plot is 23.56 kg ha^{-1} and lowest phosphorus observed in application of pendimethalin 30% EC @ 1500 g ha^{-1} . The highest available potassium in soil is application of pendimethalin 30% EC @ 600 g ha^{-1} is 185.48 kg ha^{-1} and lowest is observed with application of pendimethalin 30% EC @ 1200 g ha^{-1} is 171.73 kg ha^{-1}. Effect of treatments on soil physico-chemical properties like soil bulk density, soil pH, electric conductivity and organic carbon are not significance variation among the treatments. The available nitrogen in soil after harvest of wheat was more under hand weeded treated plots which was statistically comparable with application of pendimethalin 30% EC @ 900 g ha^{-1} over the rest of the treatments. **(**Table1.1**)**

Effect on soil biological properties

Visual observation recorded after the microbial population analysis. There was no adverse impact of the treatments application on the soil biological properties. Also the population of bacteria (*Pseudomonas fluorescens, Bacillus* spp.), fungi (*Trichoderma* spp.) and actinomycetes were comparable in various treatments. Hence, there was no adverse impact of treatment application in wheat crop on soil biological properties. **(**Table1.2**)**

Table1.1 Effect of treatments on soil pysico-chemical properties at harvest of wheat crop.

Treatment	g a.i	Formulation dose/ ha	pH	BD (Mg/ m^3)	EC (dS/ m)	Organic carbon (%)	Available		
							N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})
Pendimethalin 30% EC	600	2000 ml	7.30	1.42	0.31	0.35	110.46	18.17	185.48
Pendimethalin 30% EC	900	3000 ml	7.34	1.44	0.32	0.36	114.97	19.89	183.27
Pendimethalin 30% EC	1200	4000 ml	7.64	1.40	0.30	0.37	113.42	20.57	171.73
Pendimethalin 30% EC	1500	5000 ml	7.23	1.42	0.34	0.35	112.86	15.73	177.54
Metribuzin 70% WP	210	300 g	7.04	1.42	0.33	0.36	109.41	16.30	180.71
HW twice (20 &40 DAS)	-	-	7.55	1.43	0.30	0.33	116.34	23.56	179.77
Untreated Control (Weedy check)	-	-	7.05	1.45	0.34	0.34	103.48	18.47	173.43
SEm±			0.32	0.02	0.02	0.02	2.66	2.22	4.11
CD (P=0.05)			NS	NS	NS	NS	5.80	NS	NS

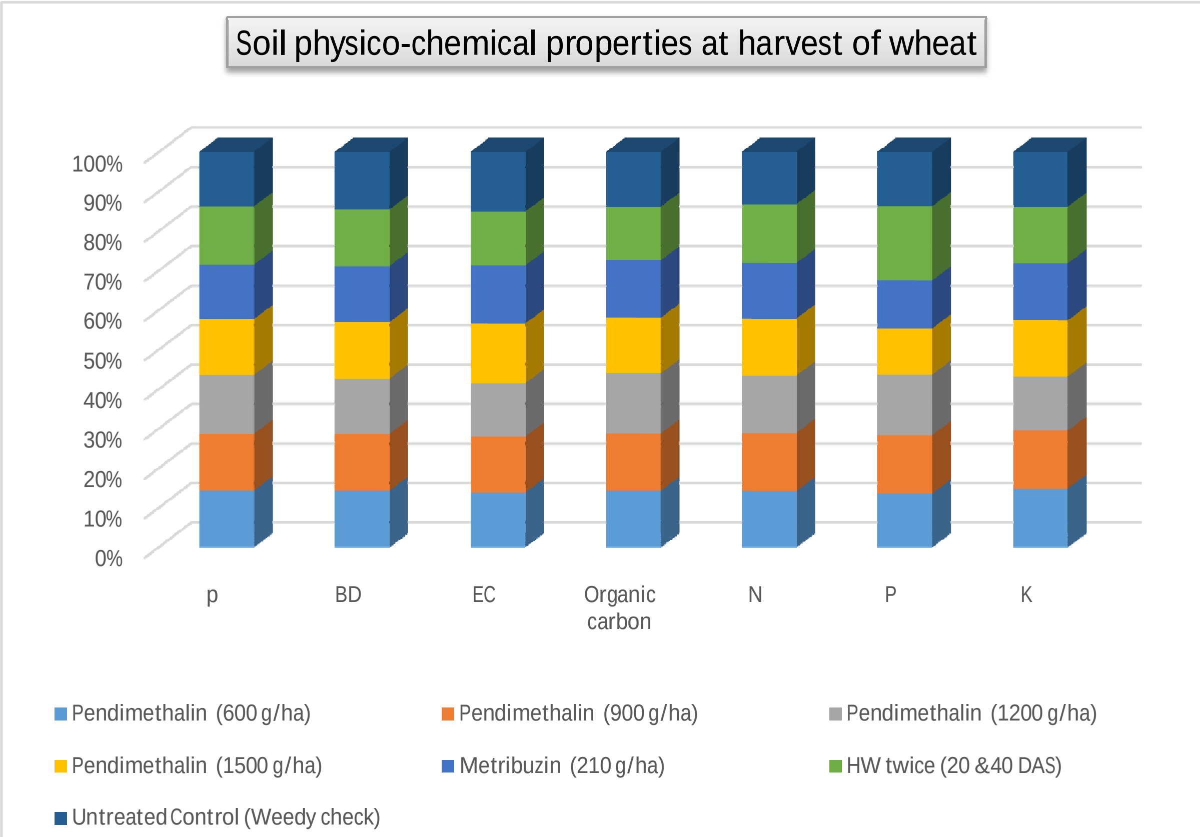
NS = Non significant

Table 1.2 Effect of treatments on soil biological properties at harvest of wheat crop.

Treatment	g a.i	Formulation dose/ ha	Mean population		
			Bacterial (1×10^3 cfu/g)	Fungi (1×10^3 cfu/g)	Actinomycetes (1×10^3 cfu/g)
Pendimethalin 30% EC	600	2000 ml	66.80	31.07	39.28
Pendimethalin 30% EC	900	3000 ml	68.93	30.67	39.28
Pendimethalin 30% EC	1200	4000 ml	71.00	29.03	38.33
Pendimethalin 30% EC	1500	5000 ml	67.53	28.20	38.47
Metribuzin 70% WP	210	300 g	72.30	29.97	38.43
HW twice (20 &40 DAS)	-	-	69.70	32.60	39.60
Untreated Control (Weedy check)	-	-	70.80	31.40	38.87
SEm±			1.71	1.26	1.86
CD (P=0.05)			NS	NS	NS

NS = Non significant

Fig 1. Effect of treatments on soil pysico-chemical properties at harvest of wheat crop.



Conclusion

With the field analysis, it can be concluded that soil bulk density, soil pH, electric conductivity and organic carbon are not significance variation among the treatments. After harvesting of wheat the available nitrogen in soil after harvest of wheat was more under hand weeded treated plots which was statistically comparable with application of pendimethalin 30% EC @ 900 g ha^{-1} over the rest of the treatments. However, available phosphorus and potassium is non-significant and it does not influenced by the treatments. There was no adverse impact of the treatments application on the soil biological properties. Also the population of bacteria (*Pseudomonas fluorescens, Bacillus* spp.), fungi (*Trichoderma* spp.) and actinomycetes were comparable in various treatments. Hence, there was no adverse impact of treatment application in wheat crop on soil biological properties.

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