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Effect of Integrated Weed Management on Growth and Yield of Fieldpea (*Pisum sativum*) under Irrigated Conditions

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ABSTRACT
A field experiments was conducted with one Fieldpea variety Rachna, three replications and eight treatments during Rabi seasons 2014-15 at GPB, Farm, NDUAT, Kumarganj, Faizabad to find out economic management for higher grain yield under integrated crop management in Fieldpea. It was found that only nutrient management (NM) by recommended dose of fertilizers (RDF) or weed management (WM) by pendimethalin @1kg a.i. ha^{-1}+one hand weeding at 30 DAS or pest management (PM) 3 g kg^{-1} seed treated with thirum 75%+carbendazim 50% (2:1) and monochrotophos 36% SL one litre ha^{-1} with spray 500 to 600 litre water not sufficient to control weed which reduce the significant yield in comparison to rest other treatments but these treatments showed higher value of most of the parameters as compare to control. Nutrient management (20:17:16:20 kg NPKS ha^{-1}) + weed management (WM) pendimethalin @1kg a.i. ha^{-1}+one hand weeding at 30 DAS + pest management (PM) 3 g kg^{-1} seed treated with thirum 75% + carbendazim 50% (2:1) and monochrotophos 36% SL one litre per ha with spray 500 to 600 litre water, weed management (WM) pendimethalin@1kg a.i. ha^{-1}+one hand weeding at 30 DAS + pest management (PM) 3 g kg^{-1} seed treated with thirum 75%+ carbendazim 50% (2:1) and nutrient management (NM) (20:17:16:20 kg NPKS ha^{-1}) + weed management (WM) pendimethalin@1kg a.i. ha^{-1}+one hand weeding at 30 DAS showed significant effect on weed dry weight in (g M^{-2}), plant height (cm), number of pod plant^{-1}, 100 seed weight (g) and grain yield kg ha^{-1} respectively over the control except final plant stand population (000/ha) and number of seed pod^{-1} were found not significant on the other hand, nutrient management (20:17:16:20 kg NPKS ha^{-1}) + pest management (PM) 3 g kg^{-1} seed treated with thirum 75% + carbendazim 50% (2:1) and monochrotophos 36% SL one litre ha^{-1} with spray 500 to 600 litre water, and weed management (WM) pendimethalin @1kg a.i. ha^{-1}+one hand weeding at 30 DAS gave yield statistically at par over the control respectively.
Key words: *Integrated weed management, herbicides, pesticides and Fieldpea (Pisum sativum).*

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INTRODUCTION

Pulse crop field pea in rotation can help to increase diversity, reduce nitrogen requirements and increase profit margins (Menalled, 2009). Despite their agronomic benefits, production can be challenging due to their limited competitive ability in the presence of weeds (Ball *et al.,* 1997; Kirkland *et al.,* 2000; Townley-Smith and Wright, 1994). Pulses are an integral part of many diets across the globe and they have great potential to improve human health, conserve our soils, protect the environment and contribute to global food security. The United Nations, declared 2016 as "International Year of Pulses" (IYP). India is the largest producer (25% of global production), consumer (27% of world consumption) and importer (14%) of pulses in the world. Pulses account for around 20 per cent of the area under food grains and contribute around 7-10 per cent of the total food grains production in the country (Mohanty and Satyasa, 2015). Fieldpea (*Pisum sativum*) cultivated around the world primarily for seed, but also as a vegetable (for leafy greens, green pods, fresh shelled green peas, and shelled dried peas), as cover crop and for fodder Andargie *et al.,* (2011). Fieldpea is one of the important *Rabi* pulse crop grown in the India for grain, and

green vegetable purpose and commonly known as pea. Despite the use of herbicidal weed control in conventional production, similar weed control problems are being faced due to increased presence of herbicide resistant weeds. As a result of this, novel and sustainable weed management strategies must be developed (Mortensen *et al.,* 2012).

Fieldpea crop suffers severely due to weed infestation resulting into wide range reduction in crop yield. The critical period of crop weed competition in field pea has been identified as 20-35 days after sowing and presence of weeds beyond this period causes severe reduction in yields (Gupta *et al.,* 2016). Hence, weed control needs to be undertaken during initial period of crop growth. Though the hand weeding is a well proven effective method of weed control, but non-availability of labour and the cost incurred in it is very high. Keeping in view of the fact, the present experiment was conducted to find out suitable and cost effective weed management practice to manage weeds during the critical period of crop weed competition.

MATERIALS AND METHODS

A field experiment was carried out in Genetics and Plant Breeding Farm, Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad-224229 (UP) in *Rabi* season 2014-15. Geographically this place is located at 26.47 ^{0}N latitudes and 82.12 ^{0}E longitudes with an altitude of 113 meters above the mean sea level. Soil was sandy loam in texture, slightly alkaline in reaction, low in organic carbon (0.31%) and available phosphorus (14.6 kg/ha), whereas soil was pH 8.2 at the start of the experiment. The experiment was laid out in random block design (RBD) with one field pea variety Rachna, eight treatments and three replications. Eight treatments were comprises as *i.e.,* **T_1**-Control, **T_2-**Nutrient management (NM) by recommended dose of fertilizers (RDF)- (20:17:16:20 kg NPKS ha^{-1}), **T_3-**Weed management (WM) by pendimethalin @1kg a.i.ha^{-1} + one hand weeding at 30 DAS, **T_4-**Pest management (PM) 3 g kg^{-1} seed treated with thirum 75%+carbendazim 50% (2:1) and monochrotophos 36% SL one litre per ha with spray 500 to 600 litre water. **T_5**-Nutrient management (20:17:16:20 kg NPKS ha^{-1}) + weed management (WM) pendimethalin @1kg a.i. ha^{-1}+one hand weeding at 30 DAS, **T_6**- Nutrient management (20:17:16:20 kg NPKS/ha) + pest management (PM) 3 g kg^{-1} seed treated with thirum 75% + carbendazim 50% (2:1) and monochrotophos 36% SL one litre per ha with spray 500 to 600 litre water, **T_7**- Weed management (WM) pendimethalin @1kg a.i. ha^{-1}+one hand weeding at 30 DAS+ pest management (PM) 3 g kg^{-1} seed treated with thirum 75% + carbendazim 50% (2:1) and monochrotophos 36% SL one litre per ha with spray 500 to 600 litre water and **T_8**- Nutrient management (20:17:16:20 kg NPKS ha^{-1}) + weed management (WM) pendimethalin @1kg a.i. ha^{-1}+one hand weeding at 30 DAS + pest management (PM) 3 g kg^{-1} seed treated with thirum 75% + carbendazim 50% (2:1) and monochrotophos 36% SL one litre per ha with spray 500 to 600 litre water, weed management (WM) pendimethalin@1kg a.i. ha^{-1} +one hand weeding at 30 DAS + pest management (PM) 3 g kg^{-1} seed treated with thirum 75%+ carbendazim 50% (2:1) and nutrient management (NM) (20:17:16:20 kg NPKS ha^{-1}) + weed management (WM) pendimethalin@1kg a.i. ha^{-1}+one hand weeding at 30 DAS. Gross and net plot sizes were 4.0 x 3.0 m and 3.5 x 2.4 m, respectively.

The graded and healthy seed of Fieldpea variety Rachna was sown manually in previously opened furrow at the depth of 4 to 6 cm and at 30 cm row to row and 10 cm plant to plant spacing on 26th October, 2014 with recommended seed rate of 100 kg ha^{-1}. The recommended dose of fertilizers was applied as per treatments in furrows just before sowing. Plant height at harvest was recorded for randomly selected five plants from each replication. Irrigation was done as per requirement of crop .The weed dry weight (g M^{-2}) were recorded by using quadrant at harvest and kept in hot air oven for recording dry weights. Weed control efficiency (%) at harvest was calculated from weed dry weight. Grain yield data was recorded on whole plot basis and then converted in to kg ha^{-1}. Data on yield components *viz*., Number of pod plant^{-1}, Number of seed pod^{-1}, and test weight (100 grain) was also recorded. All data were subjected to analysis of variance (ANOVA) as per standard procedures. Whenever 'F' ratio was found significant, critical difference (CD) value was calculated at p=0.05 to compare the treatment means.

RESULTS AND DISCUSSION

In different weed management treatments, it was found that treatments T_8 (nutrient management (20:17:16:20 kg NPKS ha^{-1}) + weed management (WM) pendimethalin @1kg a.i. ha^{-1} + one hand weeding at 30 DAS + pest management (PM) 3 g kg^{-1} seed treated with thirum 75% + carbendazim 50% (2:1) and monochrotophos 36% SL one litre per ha with spray 500 to 600 litre water), T_7 (weed management (WM) pendimethalin@1kg a.i. ha^{-1} + one hand weeding at 30 DAS + pest management (PM) 3 g kg^{-1} seed treated with thirum 75% + carbendazim 50% (2:1) and monochrotophos 36% SL one litre per ha with spray 500 to 600 litre water) and T_5 (nutrient management (NM) (20:17:16:20 kg NPKS ha^{-1}) + weed management (WM) pendimethalin@1kg a.i. ha^{-1} + one hand weeding at 30 DAS) were found very effective to control

the weeds showed lowest weed dry weight and high weed control efficiency (%) at harvest as it is shown in table 1 and Fig 1 respectively over the control. Similarly, significant number of pod plant^{-1}, 100 seed weight (g), and grain yield kg ha^{-1} were recorded in the same treatments *i.e.,* T_8 (nutrient management (20:17:16:20 kg NPKS ha^{-1}) + weed management (WM) pendimethalin @1kg a.i. ha^{-1} +one hand weeding at 30 DAS + pest management (PM) 3 g kg^{-1} seed treated with thirum 75% + carbendazim 50% (2:1) and monochrotophos 36% SL one litre per ha with spray 500 to 600 litre water), T_7 (weed management (WM) pendimethalin @1kg a.i. ha^{-1} + one hand weeding at 30 DAS + pest management (PM) 3 g kg^{-1} seed treated with thirum 75%+ carbendazim 50% (2:1) and monochrotophos 36% SL one litre per ha with spray 500 to 600 litre water) and T_5 (nutrient management (20:17:16:20 kg NPKS ha^{-1}) + weed management (WM) pendimethalin @ 1kg a.i. ha^{-1} + one hand weeding at 30 DAS) than control and rest of the parameters like final plant stand population (000/ha) and number of seed pod^{-1} not found significant as it shown in table 1& 2 and Fig 1 & 2 respectively over the control. This might be due to the efficient control of weeds by integrated weed management of herbicides. These findings are in concurrence with those of Dhonde *et al*. (2009), Idupuganti *et al*. (2005), Meena *et al*. (2010), Singh and Sekhon (2013), Sharma *et al*. (2014) and Murali *et al*. (2013) and Rao *et al.*(2015).

Table.1 Effect of integrated weed management on weeds control efficacy (%), weed dry weight in (g M^{-2}), plant height (cm) and final plant stand population at harvest in field pea

Treatments	Weed Control efficiency (%) at harvest	Weed dry weight (g/M^2)	Plant height (cm)	Final plant stand population (000/ha)
T_1: Control	-	215	83.1	333
T_2: Nutrient Management (NM)- RDF (20:17:16:20 kg NPKS/ha)	79.18	154	91.3	331
T_3: Weed management (WM)- Pendimethalin@1kg a.i./ha+one hand weeding at 30 DAS	151.77	111	96.2	332
T_4: Pest management (PM)- 3 g/kg seed treated with thirum 75%+Carbendazim 50% (2:1) and Monochrotophos 36% SL one litre per ha with spray 500 to 600 litre water	30.18	190	85.4	325
T_5: NM + WM	162.03	96	103.5	328
T_6: NM+PM	68.69	164	96.5	319
T_7: WM+PM	172.98	88	108.7	323
T_8: NM+WM+PM	219.34	55	117.7	307
SEM±	-	2.61	5.00	9.14
CD at (0.05%)	-	7.93	15.18	NS
CV%	-	3.38	8.86	4.88

Table.2 Effect of integrated weed management on number of pod plant^{-1}, number of seed pod^{-1}, 100 seed weight (g) and grain yield kg ha^{-1} at harvest in field pea crop

Treatments	Number of pod plant^{-1}	Number of seed pod^{-1}	100 seed weight (g)	Grain yield kg ha^{-1}
T_1: Control	10.5	4.4	19.28	713
T_2: Nutrient Management (NM)- RDF (20:17:16:20 kg NPKS/ha)	17.2	4.7	19.97	985
T_3: Weed management (WM)- Pendimethalin@1kg a.i./ha+one hand weeding at 30 DAS	26.5	5.1	20.89	1090
T_4: Pest management (PM)- 3 g/kg seed treated with thirum 75%+Carbendazim 50% (2:1) and Monochrotophos 36% SL one litre per ha with spray 500 to 600 litre water	14.5	4.9	20.36	829
T_5: NM + WM	30.1	5.5	21.91	1411
T_6: NM+PM	28.6	5.2	21.02	1313
T_7: WM+PM	33.4	5.6	22.02	1490
T_8: NM+WM+PM	37.1	5.8	22.16	1836
SEM±	1.49	0.33	0.28	67.6
CD at (0.05%)	4.53	NS	0.84	205.1
CV%	1.45	11.03	2.29	9.69

Treatments T_3 (weed management by pendimethalin @1kg a.i.ha^{-1} + one hand weeding at 30 DAS), T_2 (Nutrient management (NM) by recommended dose of fertilizers 20:17:16:20 kg NPKS ha^{-1}), T_6 (Nutrient management (20:17:16:20 kg NPKS ha^{-1}) + pest management 3 g kg^{-1} seed treated with thirum 75% + carbendazim 50% (2:1) and monochrotophos 36% SL one litre per ha with spray 500 to 600 litre water), and T_4 (pest management 3 g kg^{-1} seed treated with thirum 75% + carbendazim 50% (2:1) and monochrotophos 36% SL one litre per ha with spray 500 to 600 litre water) also recorded the more weed control efficiency (%) at harvest, weed dry weight (g M^{-2}), number of pods per plant (430), number of seed pod$^{-1,}$ 100 seed weight (g) and grain yield kg ha^{-1} gave yield statistically at par over the control respectively. Similar results of high weed control efficiency (WCE) in urdbean and pigeonpea was reported by Gupta *et al*. (2014) and Sharma *et al*. (2014), Kumar and Singh (2017). Data presented in table-1 and Fig.1 revealed that integrated crop management significantly influence the grain yield of fieldpea. Significantly higher grain yield 1836, 1490 and 1411 kg ha^{-1} were recorded by NM+WM+PM (T_8), WM+PM (T_7), and NM + WM (T_5) consequently rest treatment except pest management (T_4) 829 kg ha^{-1} compare to control (T_1- 713 kg ha^{-1}), respectively.

Fig.1 Effect of integrated weed management on weeds control efficacy (%), weed dry weight (g M^{-2}), plant height (cm) and final plant stand population at harvest in field pea

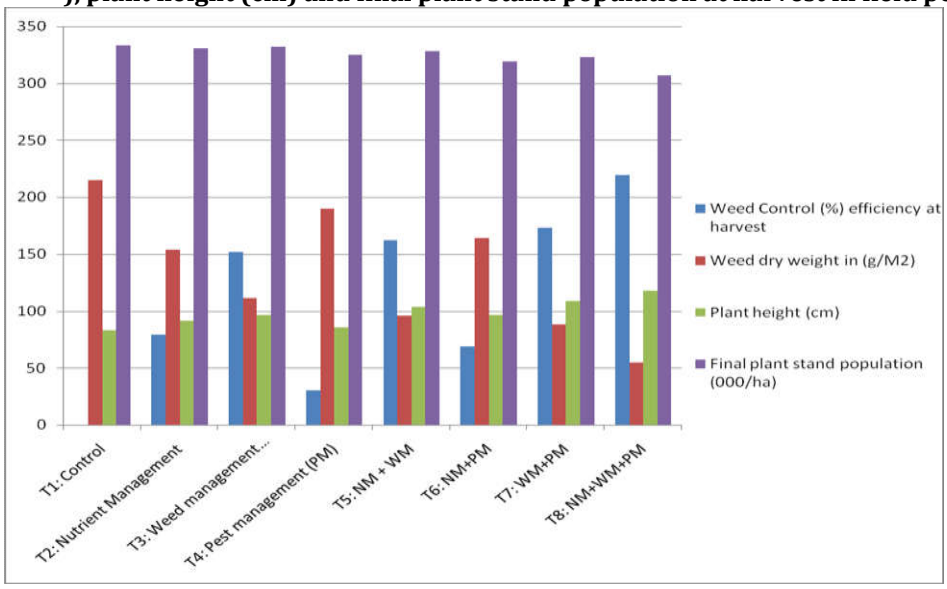
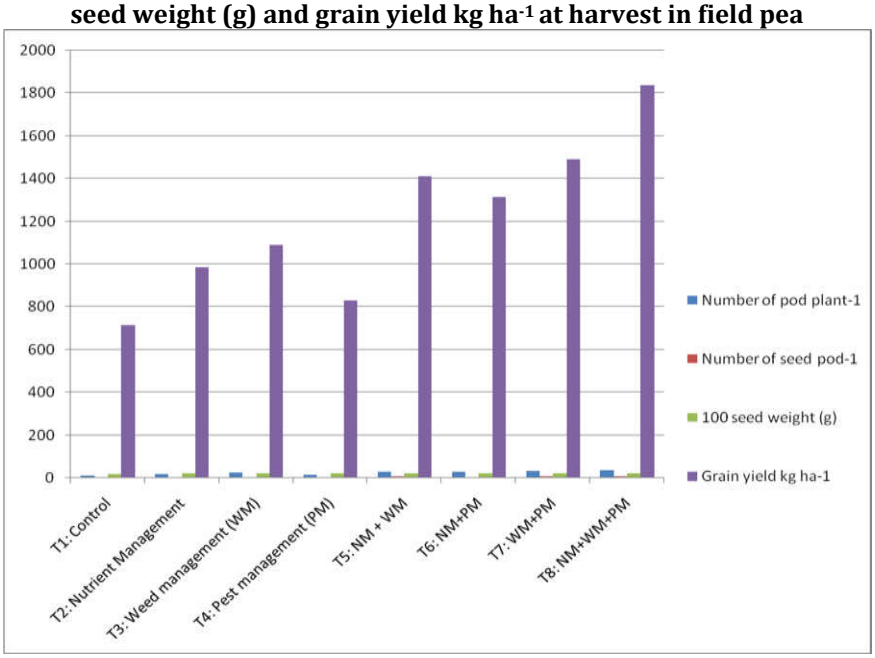


Fig.2 Effect of integrated weed management on number of pod plant^{-1}, number of seed pod^{-1}, 100 seed weight (g) and grain yield kg ha^{-1} at harvest in field pea



CONCLUSIONS

From this study, it can be concluded that weed control is a limited factor for realising higher grain yields in fieldpea. Apart from the weed free treatment, weeds can also be effectively and efficiently controlled with integration of nutrient management (20:17:16:20 kg NPKS ha^{-1}) + weed management (WM) pendimethalin @1kg a.i. ha^{-1} + one hand weeding at 30 DAS + pest management (PM) 3 g kg^{-1} seed treated with thirum 75% + carbendazim 50% (2:1) and monochrotophos 36% SL one litre per ha with spray 500 to 600 litre water) and followed by weed management (WM) pendimethalin @1kg a.i. ha^{-1} + one hand weeding at 30 DAS + pest management (PM) 3 g kg^{-1} seed treated with thirum 75% + carbendazim 50% (2:1) and monochrotophos 36% SL one litre per ha with spray 500 to 600 litre water) which ultimately results in higher grain yields of pigeonpea. In conclusion, integrated weed management is better approach for reduce the yield losses in fieldpea due to weeds.

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