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Influence of Weed Management Practices and Irrigation Schedules under Different Establishment Methods on Performance of Field Pea (*Pisum sativum* L. *arvense)*

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KEYWORDS

Pisum sativum, Establishment methods, Irrigation schedules, Weed management practices, Yield, nutrient uptake

A B S T R A C T

A field experiment was conducted during *rabi* season of 2014-15 at Crop Research Farm Maya College of Agriculture and Technology, Selaqui, Uttarakhand, India to study the "Influence of weed management practices and irrigation schedules under different establishment methods on performance of field pea (*Pisum sativum* L.var *arvense*). Twelve treatments consisted of two establishment methods (flat bed and raised bed), two irrigation schedules (no irrigation and irrigations at critical stages) and three weed management practices (weedy, HW 30 DAS and pendimethalin 1.0 kg/ha as PE) were tested in split plot design keeping combinations of establishment method and irrigation schedules in main plots and weed management in sub plots with four replications. Results revealed that density and dry matter of weeds, growth parameters (viz. Plant height, number of branches /plant, number and dry weight of nodules, dry weight of roots and dry matter accumulation), yield attributes (viz. Pods/plant, grains/pod, 1000-grains weight and grain yield/plant) and uptake of nutrients (NPK) were significantly higher under raised bed planting. Irrigation at critical stages i.e. pre-flowering and pod formation proved promising in increasing all the growth parameters, yield attributes and yield, nutrients (NPK) uptake over no irrigation. However, the density and dry matter of weeds were significantly higher under irrigated condition than no irrigation. Among the weed management treatments, HW 30 DAS treatment significantly reduced the density and dry matter of weeds and increased all the growth parameters, yield attributes and yield, nutrient uptake.

Introduction

Among the cool season food legumes, field pea (*Pisum sativum* L.) is one of the important pulse crops grown in northern India occupying an area of 0.59 m ha with a production of 0.80 m t at an average productivity of 1356 kg/ha. The domestic

production of pulses was 19.27 million tonnes from an area of 25.23 m ha in 2013-14 (DES and DAC, 2014). Field pea (*Pisum sativum* L.) is an important pulse crop grown in India and in various parts of the world. It is the cheapest source of protein for cash source to many people who live in different parts of the country.

India is the second largest producer of pea in the world after Russia and the major pea growing states are Bihar, Haryana, Punjab, H.P. Orissa, and Karnataka. Uttarakhand is also emerging as vegetable pea growing state as farmers are taking three crops in a year. Pea has high levels of amino acids, lysine and tryptophan, which are relatively low in cereal grains and contains approximately 21-25% protein and high levels of carbohydrates, are low in fiber (Yayeh *et al*., 2014). The presence of weeds in crop areas reduces the efficiency of inputs such as fertilizer and irrigation water, enhances the density of other pest organisms, and finally severely reduces crop yield and quality (Labrada *et al.* 1994). For getting higher yields it is, therefore, essential to control weeds at appropriate time with suitable methods. Weeds can be controlled either mechanically or chemically. Mechanically it can be controlled by hand pulling or hand weeding, hoeing etc but hand weeding is found to be more effective only when the weed infested area is small. Therefore, use of herbicides as a mode to control weeds is being used for effective weed control. Herbicides helps to reduce weed pressure as peas do not suppress weeds; moreover it is very effective, quick and convenient. Therefore, in order to optimize the production potential of this crop, an experimental trial was conducted.

Materials and Methods

A field experiment entitled "Influence of weed management practices and irrigation schedules under different establishment methods on performance of field pea (*Pisum sativum* L.)" was conducted during *rabi* season of 2014 -15 at Crop Research Farm, Maya College of Agriculture and Technology, Selaqui, Dehradun, Uttarakhand, India.

The soil of experimental site was sandy loam in texture having medium organic carbon (0.74%), available nitrogen (0.01616 kg ha^{-1}), phosphorus (0.0020 kg ha^{-1}) and potassium (0.015 kg ha^{-1}) contents with neutral in reaction (pH 6.7). Twelve treatments consisted of two establishment methods (flat bed and raised bed), two irrigation schedules (no irrigation and irrigations at critical stages) and three weed management practices (weedy, HW 30 DAS and pendimethalin 1.0 kg/ha as PE) were tested in split plot design keeping planting method and irrigation level in main plots and weed management in sub plots with four replications.

Results and Discussion

Total weed density, dry matter accumulation and weed control efficiency is shown in Table 1.This experiment revealed that the total weed density, dry matter accumulation and weed control efficiency was higher in raised bed and irrigation at critical stages. It might be due to reduced compaction, increased porosity and adequate moisture and nutrient supply while total weed density and dry matter accumulation was significantly higher under weedy check.

This might be due to the uncontrolled condition that favoured luxurious weed growth leading to increased weed density. Yield attributes and yield as influenced by different treatments is shown in Table 1 and 2.

Table.1 Total Weed Density, Dry Matter Accumulation and Weed Control Efficiency as Influenced by Different Treatments at 120 DAS

Treatments	**Total weed density**	**Dry matter accumulation (g/m^2)**	**Weed control efficiency (WCE %)**
A.Establishment method			
Flat bed	44.5	77.5	34.4
Raised bed	64.12	102.7	34.3
S.Em. ±	0.42	0.95	1.25
CD at 5%	1.46	3.25	4.05
B.Irrigation schedules			
No irrigation	49	83.9	40.7
Irrigation at critical stages	59.62	98.3	31.9
S.Em. ±	0.42	0.95	1.25
CD at 5%	1.46	3.25	4.05
C.Weed management practices			
Weedy	72.62	142.9	0.0
Hand weeding at 30 DAS	35.50	50.0	73.3
Pendimethalin 1.0 kg/ha as PE	56.31	79.0	37.2
S.Em ±	0.70	1.3	1.3
CD at 5%	2.04	3.7	3.7

Table.2 Growth and Development of Field Pea as Influenced by Different Treatments

Treatments	Plant population(000' plants/ha)	Plant height (cm)	No. of branches	No. of nodules/ plant	Dry weight of nodules (mg/plant)	Dry weight of roots (g/plant)	Dry matter accumulation (g/plant)
A. Establishment method							
Flat bed	303	53.3	2.7	4.0	21.67	0.525	18.31
Raised bed	323	54.9	3.1	4.4	25.58	0.564	22.08
S.E. ±	2.9	1.4	0.06	0.1	0.48	0.007	0.17
CD at 5%	8.9	2.2	0.20	0.2	1.52	0.022	0.57
B.Irrigation schedule							
No irrigation	303	53.2	2.7	4.0	21.50	0.517	17.02
Irrigation at critical stages	322	55.0	3.0	4.4	25.50	0.573	23.58
S.E. ±	2.9	1.4	0.06	0.1	0.48	0.007	0.18
CD at 5%	8.9	2.2	0.20	0.2	1.52	0.022	0.58
C.Weed management practices							
Weedy	282	53.2	2.7	3.92	1.12	0.522	18.38
Hand weeding at 30 DAS	336	55.3	3.0	4.62	6.12	0.562	22.68
Pendimethalin 1.0 kg/ha as PE	321	55.5	3.0	4.12	3.25	0.550	19.84
S.E. ±	4.9	1.4	0.07	0.1	0.42	0.004	0.39
CD at 5%	13.9	2.2	0.20	0.2	1.22	0.014	1.15

Table.3 Yield Attributes as Influenced by Different Treatments

Treatments	Number of pods per plant	Number of grains per pod	Grain yield (g/plant)	1000 grain weight(g)
A. Establishment method				
Flat bed	15.21	3.98	11.74	211.08
Raised bed	19.40	4.15	13.02	218.00
S.Em. ±	0.28	0.06	0.22	0.90
CD at 5%	0.91	NS	0.71	2.86
B. Irrigation schedule				
No irrigation	14.73	4.00	10.93	211.54
Irrigation at critical stages	19.87	4.14	13.83	217.54
S.Em. ±	0.28	0.06	0.22	0.90
CD at 5%	0.91	NS	0.71	2.86
C. Weed management practice				
Weedy	15.79	3.98	10.68	210.56
Hand weeding at 30 DAS	19.18	4.17	13.98	219.19
Pendimethalin 1.0 kg/ha as PE	16.94	4.06	12.47	213.87
S.Em. ±	0.36	0.05	0.16	0.91
CD at 5%	1.06	NS	0.47	2.66

Table.4 Grain, Straw, Biological Yields and Harvest Index of Fieldpea as Influenced by Different Treatments

Treatments	Grain yield (kg/ha)	Straw yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)
A. Establishment method				
Flat bed	2089	3167	5259	38.93
Raised bed	2524	3458	5985	41.52
S.Em. ±	36	38	52	0.52
CD at 5%	114	129	167	1.67
B. Irrigation schedule				
No irrigation	2021	3034	5094	38.65
Irrigation at critical stages	2592	3556	6151	41.80
S.Em. ±	36	38	52	0.52
CD at 5%	114	129	167	1.67
C. Weed management practice				
Weedy	1948	2987	4938	38.67
Hand weeding at 30 DAS	2606	3711	6318	42.30
Pendimethalin 1.0 kg/ha as PE	2367	3241	5611	39.71
S.Em. ±	44	38	61	0.55
CD at 5%	130	117	179	1.62

Table.5 N, P and K Content in Grains and Straw as Influenced by Different Treatments

Treatments	Nutrient content (%)					
	Grain			Straw		
	N	P	K	N	P	K
A. Establishment method						
Flat bed	2.87	0.73	0.93	0.91	0.32	0.73
Raised bed	2.88	0.74	0.94	0.91	0.33	0.72
S.Em. ±	0.04	0.01	0.01	0.01	0.01	0.01
CD at 5%	NS	NS	NS	NS	NS	NS
B. Irrigation schedule						
No irrigation	2.89	0.74	0.94	0.92	0.33	0.73
Irrigation at critical stages	2.85	0.72	0.93	0.91	0.32	0.72
S.Em. ±	0.04	0.01	0.01	0.01	0.01	0.01
CD at 5%	NS	NS	NS	NS	NS	NS
C. Weed management practice						
Weedy	2.86	0.72	0.92	0.90	0.31	0.72
Hand weeding at 30 DAS	2.89	0.75	0.94	0.92	0.33	0.73
Pendimethalin 1.0 kg/ha as PE	2.87	0.73	0.93	0.91	0.32	0.73
S.Em. ±	0.08	0.01	0.01	0.01	0.01	0.02
CD at 5%	NS	NS	NS	NS	NS	NS

Fig.1 Total Weed Density, Dry Matter Accumulation and Weed Control Efficiency as Influenced by Different Treatments at 120 DAS

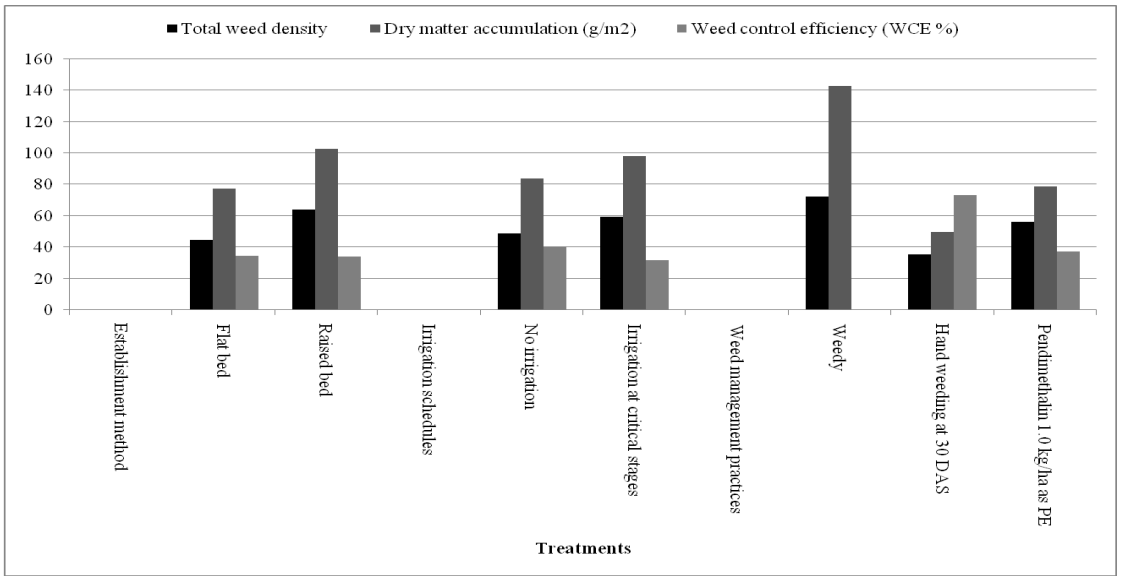


Fig.2 Growth and Development of Field Pea as Influenced by Different Treatments

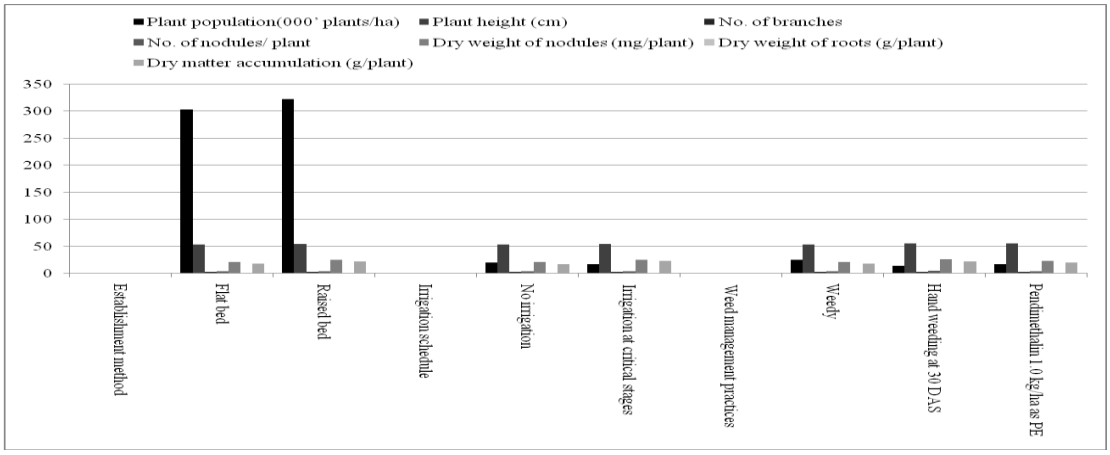


Fig.3 Yield Attributes as Influenced by Different Treatments

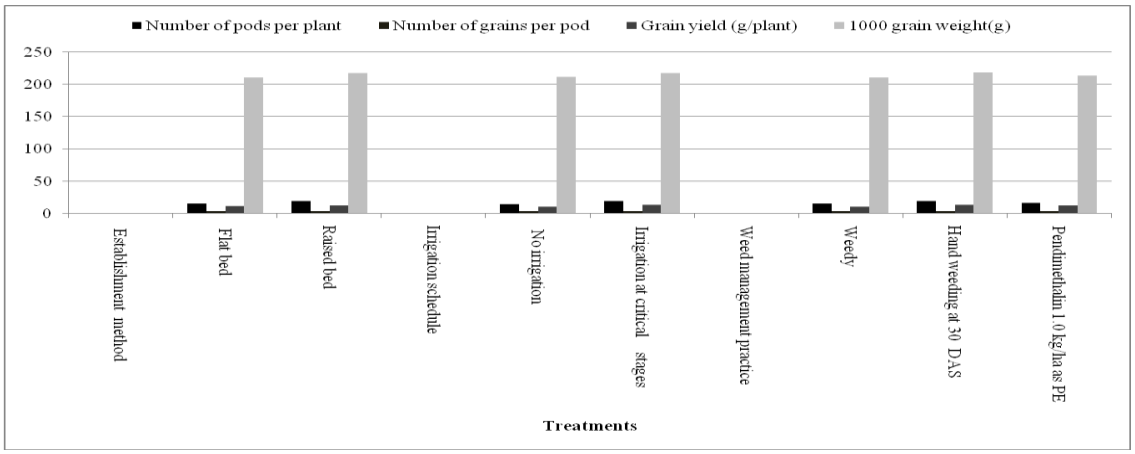


Fig.4 Grain, Straw, Biological Yields and Harvest Index of Field Pea as Influenced by Different Treatment

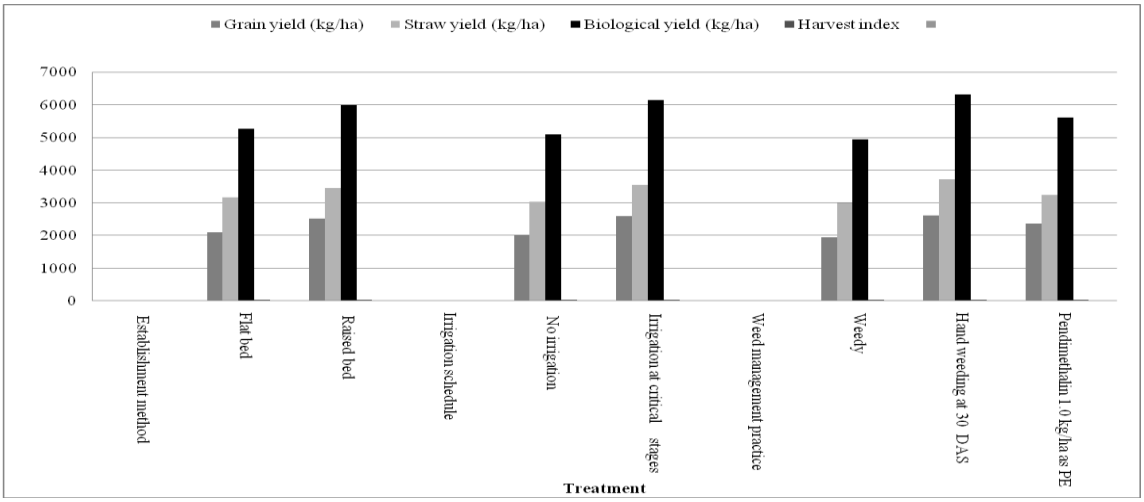
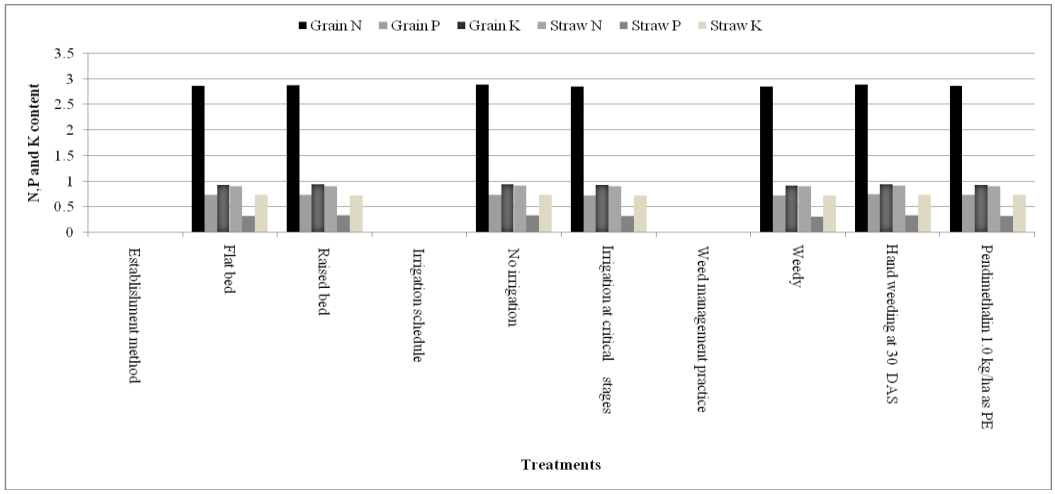


Fig.5 N, P and K Content in Grains and Straw as Influenced by Different Treatments



Yield attributes and yield of field pea was found higher in raised bed establishment method. Similar findings have been reported by Kumari *et al.* (2013). Under Irrigation schedules, irrigation at critical stages *i.e.* pre-flowering and pod formation, maximum yield attributes and yield of field pea was found. Thomas *et al.* (2010) also reported similar findings. In weed management practices, Hand Weeding 30 DAS resulted in higher yield attributes and yield of field pea. Bhooshan and Singh (2014) revealed similar results in their findings. Nutrient uptake was also found higher under raised bed establishment method, irrigation at critical stages and Hand weeding 30 DAS as shown in Table 5.

On the basis of the experimental findings it may concluded that by adopting raised bed method with two irrigations applied at critical stages i.e. pre-flowering and pod formations and one hand weeding at 30 days after sowing the production of field pea can be increased.

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