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Economical weed management practices to enhance the production of clusterbean [*Cyamopsis tetragonoloba* (L.) Taub.]

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Abstract
A field experiment entitled studies on weed management and phosphorus fertilization in clusterbean was conducted consecutively during *kharif* 2015 and 2016 at Instructional Farm (Agronomy), Rajasthan College of Agriculture, Udaipur. The test crop (Clusterbean) was growing with eight weed management treatment in main plots [pendimethalin 1.0 kg ha^{-1} as Pre emergence (PE), pendimethalin 1.0 kg ha^{-1} as PE + hand weeding (HW) 30 DAS, pendimethalin + imazethapyr 0.8 kg ha^{-1} PE, pendimethalin + imazethapyr 0.8 kg ha^{-1} PE + HW 30 DAS, imazethapyr + imazamox 0.05 kg ha^{-1} at 15 DAS, imazethapyr + imazamox 0.05 kg ha^{-1} at 15 DAS + HW 30 DAS, HW at 15 & 30 DAS and weedy check] and four phosphorus (0, 20, 40 and 60 kg ha^{-1}) levels in sub plots. Among different weed control treatments, hand weeding at 15 & 30 DAS, pre-emergence pendimethalin + imazethapyr (RM) 0.8 kg ha^{-1} PE + HW 30 DAS and post-emergence imazethapyr + imazamox (RM) 0.05 kg ha^{-1} 15 DAS+HW 30 DAS were most effective in respect of reducing weed density, weed biomass, nutrient removal by weed and to promote yield and quality of clusterbean as compared to rest of other weed control treatments. Highest seed yield (1126 kg ha^{-1}) and halum yield of clusterbean were observed in hand weeding at 15 & 30 DAS but maximum net return (Rs. 48125/-) was recorded in pendimethalin + imazethapyr (RM) 0.8 kg ha^{-1} PE + HW 30 DAS followed by imazethapyr + imazamox (RM) 0.05 kg ha^{-1} and two hand weeding at 15 & 30 DAS. Further, they were also found responsible for highest uptake of N, P and K by clusterbean crop and lowest uptake of these plant nutrients by weed plants. Application of 40 kg P_2O_5 ha^{-1} recorded significantly higher clusterbean yield and uptake of N, P and K by clusterbean crop and lowest uptake by weed plant sover rest of the treatments during both years of experimentation.

Keywords: Weed, clusterbean, pendimethalin, imazethapyr, imazamox, nutrient and yield

Introduction
Clusterbean popularly known as guar, is recognized as one of the most important commercial crops of arid and semi-arid region. It is a drought tolerant leguminous crop because of its deep tap root system and high capacity to recover from water stress. The crop is mainly grown during rainy season, but it can also be grown successfully during summer season under irrigated condition. Being a leguminous crop, it enriches the soil fertility by fixing the atmospheric nitrogen. The area under this crop in India is 56.03 lakh hectares with production of 28.84 lakh tonnes with the average productivity of 504 kg ha^{-1} (Agricultural Statistics at a Glance, 2016) [1].

Amongst agronomic factors known to augment crop production, appropriate weed control is considered to be the most important. Being a rainy season crop, it suffers badly due to severe competition by mixed weed flora. Although weeds pose problem during entire crop growth period, however, initial 30 days of sowing is very critical and presence of weeds beyond this results in yield reduction to the tune of up to 93.22 per cent. Due to unpredictability of rains, entailing to non-workable conditions of soil in rainy days and unavailability of labour at peak time, weed management in guar is really a challenging task (Singh *et al*. 2020) [19]. Manual weeding in short period of time is neither possible nor feasible, moreover, manual weeding is back breaking, costly and time consuming in heavy soils.

Therefore, chemical herbicides are being used immensely to protect the crop from weed flora. Similalr finding were also made in line with those of Sharma *et al.* (2016) [18] and Brar (2018) [5].

Application of pendimethalin alone or its ready mixture with imazethapyr as pre- emergence spray has performed well in controlling weeds in many leguminous crops. Experimental evidence is available that the use of pendimethalin and pendimethalin + imazethapyr as pre-emergence spray can completely control early emerged broad leaf and annual grassy weeds Sangwan *et al.* (2016) [15] and Punia *et al.* (2017) [13]. If the farmers skipped to apply these pre-emergence herbicides due to one or other reasons, application of post-emergence herbicide is the only option left with them (Kumawat *et al*., 2019) [10] In view of paucity of information on weed management especially the application of post emergence herbicides in clusterbean, an attempt has been made to test imazethapyr + imazamox a ready mix as post emergence, both of these herbicides belong to imidozolinone group are found effective in controlling broad spectrum weeds in many legume crops Similar finding were also reported by Sangwan *et al.* (2016) [15], Sharma *et al.* (2017) [17] and Poornima *et. al.* (2018) [12].

Amongst nutrients, phosphorus plays an important role in legumes and makes an important constituent of energy phosphates like ATP, ADP, nucleic acid, nucleoproteins, purines, pyrimidines, nucleotides and many co-enzymes (Kumawat *et al*. 2010 [9], Verma *et al*. 2017a [22], b [23] and Singh *et al*. 2020) [19]. Phosphorus application to legumes play a key role in the formation of energy rich phosphorus bonds, phospholipids and for development of root system and thus, it improves the soil nitrogen content for the succeeding non-legume crops requiring lower doses of nitrogen application (Kumawat *et al*. 2009c) [9]. Phosphorus also plays an important role in the nutritional value of legumes and improves biological nitrogen fixation and quality of grain (Raiger *et al.* 2017 [14] and Kumawat *et al*. 2020) [11]. Considering these facts the present investigation was carried out to evaluate Weed Management and Phosphorus Fertilization on growth and yield attributes of clusterbean.

Material and Methods

A field experiment was conducted at Instructional Farm of Rajasthan College of Agriculture, Udaipur during *kharif* 2015 and 2016. The experimental site was located at 24° 35' N latitude, 74°42' E longitude at an altitude of 579.5 m above mean sea level. This region falls under agro-climatic zone IVA (Sub-Humid Southern Plain and Aravalli Hills) of Rajasthan which possess typical sub-tropical climatic conditions and characterized by mild winters and moderate summers. The soil of experimental site was clay loam in texture and alkaline in reaction (pH 8.0 and 8.1). The soil was medium in available nitrogen (284.56 and 279.61 kg ha^{-1}) and phosphorus (20.42 and 19.27 kg ha^{-1}) and high in available potassium (322.83 and 319.17 kg ha^{-1}) during 2015 and 2016, respectively. The experiment was laid in split plot design with 8 weed management practices *viz.*, Pendimethalin 1.0 kg ha^{-1} as Pre-emergence (PE), Pendimethalin 1.0 kg ha^{-1} as PE + hand weed (HW) 30 DAS, Pendimethalin + imazethapyr (Ready mix=RM) 0.8 kg ha^{-1} PE, Pendimethalin + imazethapyr (RM) 0.8 kg ha^{-1} PE + HW 30 DAS, Imazethapyr + imazamox (RM) 0.05 kg ha^{-1} 15 DAS, imazethapyr + imazamox (RM) 0.05 kg ha^{-1} 15 DAS+HW 30 DAS, two HW at 15 and 30 DAS and Weedy check. The each main plot further divided into four sub plots to accommodate sub plot treatment *viz.*, phosphorus levels (0 kg ha^{-1}, 20 kg ha^{-1}, 40 kg ha^{-1} and 60 kg ha^{-1}). Test crop clusterbean was grown @ 20 kg ha^{-1} at 30 cm row to row and 10 cm plant to plant spacing. Foliar spray was done with Knapsack Sprayer using Flat Fan nozzle with 600 Littre of water ha^{-1}. Species wise predominant weed count, weed biomass, weed control efficiency were recorded at 50 days after post emergence spray (DAS), and finally the crop yield was measured at the time of harvest. Uniform application of 25 kg N ha^{-1} through urea and DAP (after adjusting the amount of N supplied through DAP) and phosphorus as per treatment through DAP was applied at sowing time through drilling

Results and Discussion

Weed flora

Eleven predominant weed species were observed in experimental field during the rainy (*kharif*) season of 2015 and 2016, Monocot weeds were predominant (57.68%) in the experimental field compared with Broad leaved weeds (42.31%) at 50 DAS. Predominant weed species in clusterbean field were *Cynodon dactylon Cyperus rotundus, Echinochloa colona, Brachiaria reptans, Dinebra retroflexa, Dactyloctenium aegyptium, Amaranthus viridi, Commelina benghalensis, Digeraarvensis, Trianthema portulacastrum* and *Physalis minima.* Similar observation was also reported by Sharma *et al.* (2017) [17], Yadav *et al.* (2017) [24] and Poornima *et al.* (2018) [12].

Weed density and biomass

Species wise weed density in clusterbean field *i.e.* number of the weed m^{-2} of a particular weed specieswas recorded at 50 DAS, and differed significantlywith the different weed management treatments (Table-1&2). Density of monocot weeds (*Cynodon dactylon, Cyperus rotundus, Echinochloa colona, Brachiaria reptans, Dinebra retroflexa, Dactyloctenium aegyptium*) were much higher than the density ofdicot weeds *Amaranthus viridis, Commelina benghalensis, Digera arvensis, Trianthema portulacastrum, Physalis minima* at throughout thecrop growing season, as because rainy season ishighly favourable for grass and sedge population,similar opinion also reported by Poornima *et. al.* (2018). The T_7 treatment two hand weeding at 15 and 30 DAS showed the maximum reductionof density and weed biomass of all category of weedat50 DAS and it was closely followed by thetreatment T_4 (ready mix application of Pendimethalin + imazethapyr (RM) 0.8 kg ha^{-1} PE + HW 30 DAS)and T_6Imazethapyr + imazamox (RM) 0.05 kg ha^{-1} 15DAS+HW 30 DAS). Theweedy check treatment (T_8) showed the highest population and biomass of monocot, dicot and total weedswhich was significantly inferior to anyother treatments. Amongst sole applied herbicides, T_1 registered maximum reduction in density and dry matter of all categories of weeds at 50 DAS.From the findings, it may be stated that hand weeding, ready mix pre and post emergence application of pendimethalin + imazethapyr (RM) 0.8 kg ha^{-1} PE + HW 30 DAS)and Imazethapyr + imazamox (RM) 0.05 kg ha^{-1} 15 DAS+HW 30 DAS) reduced the density and dry matter of broad as well as narrow leaved weeds significantly as compared to rest of the treatments.Results corroborate with the findings of Sangwan *et al.* (2016) [15], Saras *et al.* (2016) [16], Punia *et al.* (2017) [13], and Vaghela *et al.* (2018) [21].

Applications of different levels of phosphorus did not significant effect on weed density but application of phosphorus up to 60 kg ha^{-1} observed maximum dry biomass of weeds which was found significantly superior over the rest of phosphorus levels except 40 kg ha^{-1} phosphorus during the experimentations. Similar results were also reported by Ayub *et al.* (2013) [2], Begum *et al.* (2015) [3] and Bhathal and Kumar (2016) [4].

Table 1: Effect of different weed management practices on monocot weed density in clusterbean at 50 DAS (Pooled data)

Treatments	Cynodon dactylon	Cyperus rotundus	Echino chloacolona	Brachiaria reptans	Dinebra retroflexa	Dactyloctenium aegyptium
Weed management						
T_1	3.61	3.91	3.87	3.89	3.23	3.21
	(12.52)	(14.79)	(14.48)	(14.67)	(9.99)	(9.81)
T_2	3.11	2.49	2.65	2.50	2.19	2.24
	(9.19)	(5.77)	(6.53)	(5.76)	(4.30)	(4.55)
T_3	3.26	2.79	3.20	3.06	2.82	2.55
	(10.12)	(7.32)	(9.78)	(8.89)	(7.46)	(6.05)
T_4	2.53	2.10	2.09	2.05	2.08	1.91
	(5.94)	(3.93)	(3.90)	(3.75)	(3.85)	(3.21)
T_5	3.36	3.01	3.45	3.30	2.92	2.59
	(10.82)	(8.58)	(11.41)	(10.41)	(8.03)	(6.21)
T_6	2.68	2.22	2.18	2.10	2.10	1.95
	(6.71)	(4.49)	(4.29)	(3.94)	(3.91)	(3.33)
T_7	2.27	2.02	2.06	2.02	2.06	1.89
	(4.67)	(3.62)	(3.77)	(3.60)	(3.77)	(3.12)
T_8	4.43	4.49	5.73	5.26	3.64	3.68
	(19.20)	(19.78)	(32.75)	(27.25)	(12.84)	(13.23)
SEm+	0.02	0.05	0.06	0.03	0.03	0.05
CD (P=0.05)	0.07	0.13	0.18	0.10	0.08	0.13
Phosphorus (kg ha^{-1})						
0	3.13	2.88	3.12	3.03	2.62	2.49
	(9.76)	(8.58)	(10.87)	(9.74)	(6.70)	(6.10)
20	3.15	2.87	3.16	3.01	2.62	2.48
	(9.90)	(8.48)	(10.83)	(9.78)	(6.76)	(6.14)
40	3.17	2.87	3.16	3.01	2.64	2.51
	(9.95)	(8.45)	(10.90)	(9.74)	(6.85)	(6.22)
60	3.17	2.89	3.18	3.03	2.63	2.54
	(9.97)	(8.64)	(10.86)	(9.87)	(6.77)	(6.29)
SEm±	0.01	0.02	0.02	0.01	0.01	0.02
CD (P=0.05)	NS	NS	NS	NS	NS	NS

Values are x + 0.5 transformed and actual values are in parentheses

Table 2: Effect of different weed management practices on dicot weed density in clusterbean at 50 DAS (Pooled data)

Treatments	*Amaranthus viridis*	*Commelina benghalensis*	*Digera arvensis*	*Trianthema portulacastrum*	*Physalis minima*
Weed management					
T_1	3.67	4.87	3.65	4.22	2.06
	(13.02)	(23.32)	(12.91)	(17.45)	(3.75)
T_2	2.92	3.01	2.60	2.79	1.88
	(8.04)	(8.62)	(6.34)	(7.34)	(3.03)
T_3	3.18	3.38	3.10	3.05	1.91
	(9.59)	(10.91)	(9.13)	(8.95)	(3.15)
T_4	2.11	2.42	2.32	2.22	1.70
	(4.01)	(5.40)	(4.90)	(4.45)	(2.39)
T_5	3.47	3.54	3.27	3.36	1.94
	(11.59)	(12.09)	(10.24)	(10.85)	(3.27)
T_6	2.23	2.51	2.41	2.44	1.72
	(4.53)	(5.84)	(5.31)	(5.51)	(2.50)
T_7	2.03	2.40	2.30	2.13	1.66
	(3.64)	(5.27)	(4.83)	(4.07)	(2.27)
T_8	4.77	5.83	4.54	5.67	2.81
	(22.36)	(33.61)	(20.19)	(31.89)	(7.46)
SEm+	0.04	0.03	0.03	0.05	0.02
CD (P=0.05)	0.10	0.10	0.09	0.14	0.06
Phosphorus (kg ha^{-1})					
0	3.05	3.48	3.03	3.25	1.95
	(9.54)	(13.05)	(9.19)	(11.34)	(3.45)

20	3.05	3.48	3.02	3.28	1.97
	(9.59)	(13.05)	(9.19)	(11.41)	(3.45)
40	3.03	3.51	3.03	3.20	1.97
	(9.69)	(13.24)	(9.32)	(11.02)	(3.54)
60	3.05	3.52	3.02	3.22	1.95
	(9.58)	(13.19)	(9.23)	(11.48)	(3.48)
SEm±	0.02	0.02	0.02	0.02	0.01
CD (P=0.05)	NS	NS	NS	NS	NS

Values are x + 0.5 transformed and actual values are in parentheses

Weed control efficiency

Maximum weed control efficiency in monocot, dicot and total weeds (89.41, 94.07 and 92.9%, respectively)was observedwith the application of two hand weeding at 15 & 30 DAS followed by pendimethalin + imazethapyr (RM) 0.8 kg ha^{-1} PE + HW 30 DASand Imazethapyr + imazamox (RM) 0.05 kg ha^{-1} 15DAS+HW 30 DAS(Table 3). The higher weed control efficiencymay be contributedto the lowest weed competition and resulted higher grain yield. The higher weed control efficiency under these treatments could be attributed to the lower weed population and total weed dry matter as well and further it may contributedto highergrain yield. These results corroborated with the finding of Sangwan *et al.* (2016) [15], Poornima *et al.* (2018) [12] and Vaghela *et al.* (2018) [21].

Table 3: Effect of different weed management practices on total density, total dry matter and weed control efficiency in clusterbean at 50 DAS (Pooled data)

Treatments	Weed density (m^{-2}) (root transformed)			Weed dry matter (g m^{-2})			WCE (%)		
	Monocot	Dicot	Total	Monocot	Dicot	Total	Monocot	Dicot	Total
Weed management									
T_1	8.76	8.41	12.13	413.02	737.73	1150.75	58.92	45.98	51.46
T_2	6.04	5.81	8.36	151.05	150.62	301.67	84.98	88.97	87.28
T_3	7.07	6.49	9.58	269.03	255.50	524.53	73.24	81.29	77.88
T_4	5.00	4.65	6.79	122.67	90.41	213.08	87.80	93.38	91.01
T_5	7.48	6.96	10.19	359.02	320.57	679.60	64.29	76.52	71.34
T_6	5.20	4.91	7.12	133.04	106.69	239.73	86.77	92.19	89.89
T_7	4.78	4.53	6.56	106.49	80.94	187.43	89.41	94.07	92.09
T_8	11.18	10.75	15.50	1005.36	1365.55	2370.91	0.00	0.00	0.00
SEm+	0.08	0.07	0.10	6.42	8.90	14.91	-	-	-
CD (P=0.05)	0.23	0.20	0.29	18.61	25.78	43.20	-	-	-
Phosphorus (kg ha^{-1})									
0	6.91	6.56	9.50	293.12	361.49	654.60	-	-	-
20	6.91	6.57	9.51	312.98	381.84	694.81	-	-	-
40	6.95	6.55	9.53	334.03	402.40	736.43	-	-	-
60	6.98	6.58	9.56	339.72	408.29	748.01	-	-	-
SEm±	0.03	0.03	0.04	3.65	3.83	6.37	-	-	-
CD(P=0.05)	NS	NS	NS	10.24	10.76	17.89	-	-	-

Nutrient uptake by crop

Application of herbicides alone or in combination and two hand weeding resulted in significantly higher nutrient (N, P and K) uptake by clusterbean as compared to weedy check (Table 4). Two hand weeding recorded maximum total N, P and K uptake by clusterbean (219.30, 21.61, and 57.21 kg ha^{-1})which was significantly superior over rest of weed control treatments, respectively. Next order of superiority was the effect of pendimethalin + imazethapyr (RM) 0.8 kg ha^{-1} PE + HW 30 DAS and imazethapyr + imazamox (RM) 0.05 kg ha^{-1} 15DAS+HW 30 DAS. The concurrent use of herbicides significantly gave more nutrient uptake as against individual herbicide application. Application of phosphorus levels up to 40 kg ha^{-1} brought about a significant increase in nitrogen, phosphorus and potassium uptake by plant during both the years as well as on pooled analysis. On pooled basis per cent increase in N, P and K uptake due to application of 40 kg P_2O_5 ha^{-1} over control was 76.86, 24.78 and 16.42 respectively. Results so obtained are in close conformity with the finding of Kumawat *et al.* (2009) a [6], b [7], Bhathal and Kumar (2016) [4], Raiger *et al.* (2017) [14] and Yadav *et al.* (2014) [24].

Table 4: Effect of different weed management practices on nutrient uptake by clusterbean at 50 DAS (Pooled data)

Treatments	N uptake (Kg ha^{-1})			P uptake (Kg ha^{-1})			K uptake (Kg ha^{-1})		
	Monocot	Dicot	Total	Monocot	Dicot	Total	Monocot	Dicot	Total
Weed management									
T_1	7.07	15.73	22.81	1.02	2.40	3.41	7.29	10.49	17.78
T_2	2.61	3.22	5.83	0.38	0.50	0.88	2.70	2.15	4.85
T_3	4.62	5.46	10.08	0.67	0.84	1.51	4.77	3.64	8.41
T_4	2.13	1.93	4.07	0.31	0.30	0.61	2.20	1.29	3.50
T_5	6.15	6.85	13.00	0.89	1.04	1.93	6.35	4.57	10.92
T_6	2.31	2.28	4.60	0.34	0.35	0.69	2.39	1.53	3.91
T_7	1.87	1.73	3.60	0.27	0.27	0.55	1.92	1.16	3.08
T_8	17.12	29.09	46.21	2.45	4.42	6.87	17.71	19.44	37.15
SEm+	0.11	0.22	0.32	0.02	0.04	0.05	0.11	0.16	0.25
CD (P=0.05)	0.33	0.63	0.94	0.05	0.10	0.15	0.32	0.46	0.74

Phosphorus (kg ha^{-1})									
0	4.83	7.48	12.31	0.64	1.08	1.71	5.02	5.01	10.03
20	5.35	8.14	13.49	0.77	1.24	2.01	5.54	5.43	10.97
40	5.83	8.69	14.52	0.87	1.36	2.23	5.99	5.78	11.77
60	5.94	8.84	14.78	0.89	1.39	2.27	6.12	5.91	12.03
SEm±	0.06	0.08	0.12	0.01	0.01	0.02	0.06	0.06	0.10
CD (P=0.05)	0.18	0.23	0.35	0.03	0.04	0.06	0.18	0.16	0.28

Yield attributes and yield

Enforcing weed control through hand weeding, individual herbicides and their mixture resulted in significant increase in seed yield, haulm and biological yield. Application of hand weeding at 15 and 30 DAS achieved significantly higher seed, haulm and biological yield (1126, 2400 and 3526kg ha^{-1}) closely followed by pendimethalin + imazethapyr (RM) 0.8 kg ha^{-1} PE + HW 30 DASand imazethapyr + imazamox (RM) 0.05 kg ha^{-1} 15DAS+HW 30 DAS.The better expression of yield attributes and yield might be poor resurgence frequency and growth of weeds as evident from weed dry matter studies in these treatments. Hence, weeds were unable to compete with the crop plant for different growth factors. Various authors have also reported improved yield attributed with reduced weed density and dry matter Sharma *et al.* (2017) [17], Yadav and Mundra (2017) [24], and Brar *et al.* (2018) [5]. Data presented in the Table 5 indicate that successive increase in phosphorus levels up to 40 kg ha^{-1} significantly increased seed, halum and biological yield over its preceding lower levels but at decreasing rate and further increase failed to increase the yield at significant level. The per cent increase in seed, halum and biological yield due to 40 kg P_2O_5 ha^{-1} was 40.64, 27.93 and 31.73, respectively. Similar results were also reported by Kumwat *et al*. (2009c) [8], Kumawat *et al*. (2010) [20], Singh *et al*. (2017) [20] and Kumawat *et al*. (2020) [11].

Table 5: Effect of different weed management practices on yield and economics of clusterbean

Treatments	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest Index (%)	Net Return (₹ ha^{-1})	B:C Ratio
Weed management						
T_1	655	1519	2174	30.11	23421	1.36
T_2	974	2179	3154	30.93	39944	1.99
T_3	837	1731	2568	32.53	33828	1.97
T_4	1119	2313	3432	32.65	48125	2.41
T_5	805	1646	2451	32.83	32338	1.95
T_6	1080	2223	3304	32.77	46334	2.39
T_7	1126	2400	3526	31.59	46323	2.05
T_8	380	1214	1594	23.32	9955	0.65
SEm+	22	56	64	0.68	1180	0.06
CD (P=0.05)	63	164	185	1.97	3418	0.17
Phosphorus (kg ha^{-1})						
0	684	1604	2288	29.03	25472	1.45
20	862	1861	2723	31.22	34774	1.89
40	962	2052	3014	31.53	39846	2.06
60	981	2095	3076	31.58	40042	1.98
SEm±	8	20	25	0.20	436	0.02
CD (P=0.05)	21	57	70	0.57	1224	0.06

Economics

Needless to state that the two hand weeding at 15 and 30 DAS proved best performance on all parameters recorded during the study. But, ready mix pre-emergence application of pendimethalin + imazethapyr (RM) 0.8 kg ha^{-1} PE + HW 30 DASgave the higher seed yield (1119 kg ha^{-1}), net returns (₹ 48125 ha^{-1}) and B:C ratio (2.41) on pooled basis (Table 6).Therefore, it is concluded that the clusterbean crop grown with pre-emergence application of pendimethalin + imazethapyr (RM) 0.8 kg ha^{-1} PE + HW 30 DASfound the best practice to get higher grain yield and net return. Application of 40 kg phosphorus ha^{-1} proved better with nutrient uptake and yield of clusterbean.

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