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#### Rajnish Anand

Ph.D. Student, Department of  
 Agronomy, S.D.J.P.G. College,  
 Veer Bahadur Singh Purvanchal  
 University, Jaunpur, Uttar  
 Pradesh, India

#### Dr. Phool Chandra Singh

Professor and H.O.D.,  
 Department of Agronomy,  
 S.D.J.P.G. College, Veer  
 Bahadur Singh Purvanchal,  
 Jaunpur, Uttar Pradesh, India

## Residual effect of succeeding crop under weed management on black gram-mustard cropping system

Rajnish Anand and Dr. Phool Chandra Singh

### Abstract

The experiment was conducted at Sri Durgajee Post Graduate College, Chandeshwar, Azamgarh, (U.P.) during rainy and winter seasons of 2019-20 and 2020-21. To study the Residual effect of succeeding crop under weed management on black gram-mustard cropping system. The experiment was laid out in a RBD with 16 treatments i.e. Imazthapyr 50g/haPRE (T1), Imazthapyr 70g/haPRE (T2), Imazthapyr 80g/haPRE (T3), Imazthapyr 50g/haPOE (T4), Imazthapyr 70g/haPOE (T5), Imazethapyr 80g/ha POE (T6), Imazethapyr.+Imazemox (RM) 50g/haPRE (T7), Imazethapyr.+Imazemox (RM) 70g/haPRE (T8), Imazethapyr.+Imazemox (RM) 80g/haPRE (T9), Imazethapyr.+Imazemox (RM) 50g/haPOE (T10), Imazethapyr.+Imazemox(RM) 70g/haPOE(T11), Imazethapyr.+Imazemox(RM) 80g/haPOE (T12), Pendimethalin1000g/ha PRE (T13), Imazethapyr + Pendimethalin (RM)1000g/ha PRE (T14), Hoeing twice (T15) each performed at 20 and 40 DAS and weedy check (T16) replicated thrice. Blackgram var. T9 and mustard var. Shivani was sown at 30 cm using 30 and 8 kg seed/ha, with RDF 20:40:20 and 80:40:20 kg/ha, respectively. Application of Imazethapyr.+Imazemox (RM) 80g/ha POE (T12) also recorded higher growth parameters plant height, dry matter, leaf area index, grain and straw yield compared to rest of weed treatments.

**Keywords:** herbicides, plant height, dry matter, leaf area index

### Introduction

Pulses are a good source of supplementary protein to daily diets based on cereals and starchy food for a predominantly vegetarian population and for those who cannot afford expensive animal protein. Pulses are therefore often regarded as poor man's meat. Pulses occupy a special place in human nutrition with protein (24%), carbohydrates (59.6%), fat (1.5%), minerals (3.2%) and it also contains 154 mg calcium, 9.1 mg iron and 38 mg beta-carotene per 100 g of dal. Their cultivation enriches soil by adding nitrogen and improves the physical, chemical and biological soil properties. Their short growing period and photoperiod sensitivity make them suitable for crop intensification and diversification. The average productivity of Black gram in Uttar Pradesh is far below as compared to other developed states like Andhra Pradesh, Madhya Pradesh, Maharashtra etc. The major cause of low productivity of black gram is weed as this crop is grown during rainy season which is known for heavy weed flux. Yield loss due to uncontrolled weed growth in black gram ranges from 27 to 100% (Singh & Singh, 2010) [6]. Most sensitive period of weed competition is in between 3 to 6 weeks after sowing. Preceding crops certainly influence the growth of the crop grown in recurrent succession on the same piece of land. Knowledge on direct and residual effects of herbicide in cropping sequence is of great importance, where succeeding crop follow preceding crop in quick succession and herbicide residues left over may affect the succeeding sensitive crop in rotation. Herbicide structure and soil and climatic conditions prevailing during and after the application of herbicides and their application methods also influence the persistence of herbicides in the soil and plant (Sondhia *et al.*, 2015) [7].

### Materials and Methods

The experiment was conducted at Sri Durgajee Post Graduate college, Chandeshwar, Azamgarh, (U.P.) during rainy and winter seasons of 2019-20 and 2020-21. The experiment was laid out in a RBD with 16 treatments i.e. Imazthapyr 50g/haPRE (T1), Imazthapyr 70g/haPRE (T2), Imazthapyr 80g/haPRE (T3), Imazthapyr 50g/haPOE (T4), Imazthapyr 70g/haPOE (T5), Imazethapyr 80g/haPOE (T6), Imazethapyr.+Imazemox (RM) 50g/haPRE (T7), Imazethapyr.+Imazemox (RM) 70g/haPRE (T8), Imazethapyr.+Imazemox (RM) 80g/haPRE (T9), Imazethapyr.+Imazemox (RM) 50g/haPOE (T10), Imazethapyr.+Imazemox (RM)

#### Corresponding Author:

#### Rajnish Anand

Ph.D. Student, Department of  
 Agronomy, S.D.J.P.G. College,  
 Veer Bahadur Singh Purvanchal  
 University, Jaunpur, Uttar  
 Pradesh, India

80g/haPOE (T12), Pendimethalin1000g/ha PRE (T13), Imazethapyr + Pendimethalin (RM)1000g/ha PRE (T14), Hoeing twice (T15) each performed at 20 and 40 DAS and weedycheck (T16) replicated thrice. Blackgram *var.* T9 and mustard *var.* Shivani was sown at 30 cm using 30 and 8 kg seed/ha, with RDF 20:40:20 and 80:40:20 kg/ha, respectively.

## Results and Discussion

### Plant height at maturity

Plant height was influenced significantly by different herbicides and hoeing during 2019, 2020 and under pooled data. Among various levels and time of application of imazethapyr @ 80g/ha as pre emergence (T3) was similar to imazethapyr @ 80 g/ha post emergence (T6), imazethapyr + imazamox (RM) @70g/ha pre emergence (T8), imazethapyr + imazamox (RM) @80g/ha pre emergence (T9) and pendimethalin 1000g/ha pre emergence (T13) during 2019, 2020 and under pooled data also similar to imazethapyr + imazamox (RM)@ 50g/ha post emergence (T10) and hoeing twice (T15) during 2019 and 2020 and similar to imazethapyr + pendimethalin(RM) @ 1000g/ha (T14) during 2020 recorded higher plant height compare to weedy check (T16).

Application of imazethapyr + imazamox(RM) @80g/ha post emergence (T12) being similar to imazethapyr @80g/ha pre emergence (T3) and imazethapyr + imazamox (RM)@70g/ha post emergence (T11) during 2019 and under pooled data and also similar with imazethapyr + imazamox (RM)@80g/ha pre emergence (T9), imazethapyr + imazamox (RM)@70g/ha pre emergence (T8) and pendimethalin 1000g/ha pre emergence (T13) during 2019 while it was highly significant to rest of the herbicidal treatments during 2020 recorded higher plant height as compared to weedy check (T16).

Pendimethalin 1000g/ha pre emergence (T13) was similar to all the herbicidal treatments except (T3) and weedy check (T16) during 2019 while it was similar to imazethapyr @ 80 g/ha post emergence (T6), imazethapyr + imazamox (RM)@ 70g/ha pre emergence (T8), imazethapyr + imazamox(RM) @ 80g/ha pre emergence (T9), imazethapyr + imazamox(RM) @ 50g/ha post emergence (T10) during 2020 and under pooled data and also similar with imazethapyr @ 70 g/ha post emergence (T5), imazethapyr + pendimethalin(RM) @ 1000g/ha (T14) and hoeing twice (T15) during 2020 recorded higher plant height compared to weedy check. by Thakare *et al.*, (2002) [8]. Baskaran and Solaimalai (2002) [1] observed that parameters like plant height were significantly affected by the various treatments of herbicides on black gram. Plant height of mustard did not differ significantly by residual effect of weed control methods performed in black gram.

### Leaf area index at maturity

Leaf area index was influenced significantly by different herbicide and hoeing during 2019, 2020 and under pool data. Among various levels and time of application of imazethapyr @ 80g/ha pre emergence (T3) being similar with pendimethalin 1000g/ha pre emergence (T13) during 2019,2020 and under pooled data and also similar with imazethapyr + imazamox(RM) @ 80g/ha pre emergence (T9) during 2019 and under pool data and also similar with imazethapyr + imazamox(RM) @ 70g/ha pre emergence (T8) during 2019 recorded higher leaf area index compared to weedy check (T16) during 2019, 2020 and under pooled data. Among various herbicides, application of imazethapyr + imazamox (RM) @ 80g/ha post emergence (T12) was highly

significant to rest of all herbicide treatment recorded higher leaf area index compared to weedy check (T16) during 2019, 2020 and under pooled data.

Pendimethalin 1000g/ha pre emergence(T13) was similar with imazethapyr + imazamox(RM) @ 70g/ha pre emergence (T8), imazethapyr + imazamox(RM) @ 80g/ha pre emergence (T9) during 2019 and under pooled data and also similar with imazethapyr @ 80g/ha pre emergence (T3) during 2020 recorded higher leaf area index compared to weedy check during 2019, 2020 and pooled data. Weedy plots restricts light interception thus recorded lower LAI. These views were confirmed by Sangeetha *et al.*, (2012) [5] and Choudhary *et al.*, (2012) [3]. LAI of mustard did not differ significantly by residual effect of weed control methods performed in black gram.

### Dry weight at maturity

Dry weight of blackgram plant was influenced significantly by different herbicides and hoeing during 2019, 2020 and under pooled data. Among various levels and time of application of imazethapyr @ 80g/ha pre emergence (T3) being similar to imazethapyr + imazamox(RM) @ 70g/ha post emergence (T11) during 2020 while significantly higher over rest of the herbicidal treatments during 2019 and under pooled data recorded higher weed dry matter as compared to weedy check (T16) during 2019,2020 and under pooled data.

Application of imazethapyr + imazamox(RM) @ 80g/ha post emergence (T12) being significantly higher over rest of the treatment during 2019, 2020 and under pooled data recorded higher crop dry matter as compared to weedy check (T16).

Pendimethalin 1000g/ha pre emergence (T13) was similar with imazethapyr + imazamox(RM) @ 80g/ha pre emergence (T9) during 2019, 2020 and under pooled data and also similar with imazethapyr + imazamox(RM) @ 70g/ha pre emergence (T8) during 2019, 2020 and similar with imazethapyr @ 80g/ha post emergence (T6) during 2015 recorded higher crop dry matter as compared to weedy check. Similar finding was reported earlier by Priya *et al.*, (2017) [4]. Among different herbicidal treatments. Dry matter of mustard did not differ significantly by residual effect of weed control methods performed in black gram.

### Yield

Yield of blackgram as influenced by different weed control methods are presented in Table 3. Seed yield of black gram was significantly influenced by different weed control methods during 2019, 2020 and under pooled data. Among various levels and time of application of imazethapyr @ 80g/ha as pre emergence recorded higher grain and straw yield compared to weedy check (T16) during 2019, 2020 and under pooled data. However it was similar to imazethapyr @ 80g/ha post emergence (T6), imazethapyr + imazamox(RM) @ 70g/ha pre emergence (T8), imazethapyr + imazamox(RM) @ 80g/ha pre emergence (T9) and pendimethalin 1000g/ha pre emergence (T13) during 2019, 2020 and under pooled data also similar with imazethapyr + imazamox (RM) @70g/ha post emergence (T10), imazethapyr + pendimethalin (RM) 1000g/ha pre emergence (T14) and hoeing twice (T15) during 2019 and 2020 and similar with imazethapyr @ 50g/ha pre emergence (T1), imazethapyr @ 70g/ha pre emergence (T2), imazethapyr @ 50g/ha post emergence (T4) and imazethapyr @ 70g/ha post emergence (T5) during 2020.

Application of imazethapyr + imazamox(RM) @ 80g/ha post

emergence (T12) recorded higher seed and straw yield compared to weedy check during 2019, 2020 and under pooled data, but it was on par with imazethapyr @ 80g/ha pre emergence (T3), imazethapyr + imazamox(RM) @ 80g/ha pre emergence (T9), imazethapyr + imazamox (RM)@ 70g/ha post emergence (T11) and pendimethalin 1000g/ha pre emergence (T13) during 2014, 2015 and under pooled data also similar with imazethapyr @ 80g/ha post emergence (T6), imazethapyr + imazamox(RM) @ 70g/ha pre emergence (T8) during 2019 and 2020 also similar with imazethapyr @ 50g/ha pre emergence (T1), imazethapyr @ 70g/ha pre emergence (T2), imazethapyr @ 70g/ha post emergence (T5), imazethapyr + imazamox(RM) @70g/ha post emergence (T10), imazethapyr + pendimethalin(RM) 1000g/ha pre emergence (T14) and hoeing twice (T15) during 2020.

Pendimethalin 1000g/ha pre emergence (T13) was similar to imazethapyr @ 80g/ha post emergence (T6), imazethapyr + imazamox(RM) @ 70g/ha pre emergence (T8), imazethapyr + imazamox(RM) @ 80g/ha pre emergence (T9) during 2019, 2020 and under pooled data recorded higher seed and straw yield compared to weedy check during 2019, 2020 and under

pooled data. Also similar with imazethapyr + pendimethalin(RM) 1000g/ha pre emergence (T14) and hoeing twice (T15) during 2019 and 2020 and similar to imazethapyr @ 80g/ha pre emergence (T3), imazethapyr + imazamox(RM) @ 70g/ha pre emergence (T8) during 2019 while imazethapyr @ 50g/ha pre emergence (T1), imazethapyr @ 70g/ha pre emergence (T2), imazethapyr @ 70g/ha post emergence (T5) during 2020. These results are confirmed with the finding of Chavan *et al.*, (2016)<sup>[2]</sup>.

Yield of mustard as influenced by residual effect of weed control methods performed in black gram are presented in Table. Grain yield and straw yield of mustard did not differ significantly by residual effect of weed control methods performed in black gram. However imazethapyr + imazamox @ 80g/ha post emergence (T12) recorded maximum growth parameter, grain yield and straw yield during 2019-2020, 2020-2021 and under pooled data, respectively. Imazethapyr + Imazamox (RM) @ 80g/ha post emergence (T12) followed by Imazethapyr + Imazamox (RM) @ 70g/ha post emergence (T11) recorded maximum straw yield under pooled data as compare to all other treatments (Table 2 & 4).

**Table 1:** Growth parameter at maturity as influenced by weed control method in black gram crop.

Treatment	2019			2020			Pool		
	Plant Height(cm)	dry weight (gm-2)	Leaf Area Index	Plant Height(cm)	dry weight (gm-2)	Leaf Area Index	Plant Height(cm)	dry weight (gm-2)	Leaf Area Index
T1(Imaze. 50g/haPRE)	43.01	260.81	0.54	45.36	275.54	0.55	44.19	268.17	0.54
T2(Imaze. 70g/haPRE)	45.03	267.03	0.50	46.51	282.20	0.56	45.77	274.62	0.53
T3(Imaze. 80g/haPRE)	49.96	341.32	0.67	56.89	348.21	0.70	53.42	344.77	0.68
T4(Imaze. 50g/haPOE)	42.89	272.14	0.50	47.13	274.27	0.55	45.01	273.20	0.52
T5(Imaze. 70g/haPOE)	44.36	273.47	0.51	46.51	279.94	0.56	45.43	276.71	0.54
T6(Imaze. 80g/haPOE)	45.78	273.56	0.57	49.18	290.94	0.58	47.48	282.25	0.58
T7(Imaze.+Imazemox 50g/haPRE)	41.86	269.03	0.44	44.47	270.83	0.57	43.16	269.93	0.51
T8((Imaze.+Imazemox 70g/haPRE)	46.51	272.90	0.59	54.69	282.72	0.60	50.60	277.81	0.59
T9((Imaze.+Imazemox 80g/haPRE)	48.23	277.88	0.60	54.92	284.73	0.62	51.58	281.31	0.61
T10((Imaze.+Imazemox 50g/haPOE)	45.19	262.06	0.54	54.70	289.23	0.60	49.95	275.65	0.57
T11((Imaze.+Imazemox 70g/haPOE)	51.77	366.58	0.68	61.10	374.34	0.75	56.43	370.46	0.71
T12((Imaze.+Imazemox 80g/haPOE)	53.64	397.33	0.78	66.22	413.55	0.83	59.93	405.44	0.80
T13(Pendim.1000g/haPRE)	49.38	335.46	0.64	52.04	337.69	0.68	50.71	336.58	0.66
T14(Imaze.+Pendi.1000g/ha)	44.56	260.19	0.51	47.53	279.60	0.56	46.04	269.89	0.53
T15(Hoeing twice)	45.03	261.91	0.53	47.82	287.81	0.58	46.42	274.86	0.55
T16(weedycheck)	41.54	238.65	0.39	39.77	245.09	0.49	40.66	241.87	0.44
S.Em±	2.05	20.39	0.05	3.91	14.98	0.04	2.25	13.75	0.03
CD=(0.05)	6.13	60.83	0.14	11.66	44.70	0.11	6.73	41.03	0.10
CV%	7.70	12.20	14.29	13.29	8.62	10.05	8.04	8.07	9.54

**Table 2:** Growth parameter at maturity as influenced by weed control method in mustard crop.

Treatment	2019			2020			Pool		
	Plant Height (cm)	dry weight (gm-2)	Leaf Area Index	Plant Height(cm)	dry weight (gm-2)	Leaf Area Index	Plant Height(cm)	dry weight (gm-2)	Leaf Area Index
T1(Imaze. 50g/haPRE)	126.64	331.54	1.55	136.47	335.81	1.76	131.55	333.67	1.65
T2(Imaze. 70g/haPRE)	129.97	332.20	1.61	137.76	342.03	1.64	133.87	337.12	1.62
T3(Imaze. 80g/haPRE)	134.94	331.55	1.66	141.72	366.32	1.89	138.33	348.94	1.78
T4(Imaze. 50g/haPOE)	123.31	334.27	1.54	136.99	347.14	1.76	130.15	340.70	1.65
T5(Imaze. 70g/haPOE)	125.33	329.94	1.63	128.44	348.47	1.68	126.88	339.21	1.66
T6(Imaze. 80g/haPOE)	135.28	340.94	1.51	135.60	348.56	1.86	135.44	344.75	1.68
T7(Imaze.+Imazemox 50g/haPRE)	124.50	331.83	1.66	125.10	344.03	1.67	124.80	337.93	1.66
T8((Imaze.+Imazemox 70g/haPRE)	134.31	332.72	1.57	141.86	347.90	1.66	138.08	340.31	1.62
T9((Imaze.+Imazemox 80g/haPRE)	141.61	334.73	1.64	141.86	352.88	1.72	141.74	343.81	1.68
T10((Imaze.+Imazemox 50g/haPOE)	131.33	332.57	1.50	139.11	337.06	1.76	135.22	334.81	1.63
T11((Imaze.+Imazemox 70g/haPOE)	136.33	334.34	1.67	149.87	341.58	1.91	143.10	337.96	1.79
T12((Imaze.+Imazemox 80g/haPOE)	149.22	363.55	1.68	152.33	372.33	1.94	150.77	367.94	1.81
T13(Pendim.1000g/haPRE)	143.39	314.36	1.53	142.33	310.46	1.69	142.86	312.41	1.61

T14(Imaze.+Pendi.1000g/ha)	131.25	319.60	1.56	138.93	335.19	1.77	135.09	327.39	1.67
T15(Hoeing twice)	131.25	335.09	1.66	136.60	336.91	1.73	133.93	336.00	1.70
T16(weedy check)	123.83	331.14	1.69	135.44	313.65	1.54	129.64	322.40	1.61
S.Em±	8.74	11.21	0.05	5.75	20.39	0.11	4.77	10.20	0.06
CD=(0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV%	11.42	5.83	5.63	7.18	10.31	11.11	6.09	5.23	6.32

**Table 3:** Yield (Kg/ha) as influenced by weed management in black gram crop.

Treatment	2019		2020		Pool	
	Seed Yield	Straw Yield	Seed Yield	Straw Yield	Seed Yield	Straw Yield
T1(Imaze. 50g/haPRE)	825	1856	869	1876	847	1866
T2(Imaze. 70g/haPRE)	898	1921	919	2109	908	2015
T3(Imaze. 80g/haPRE)	1057	2560	1076	2685	1066	2622
T4(Imaze. 50g/haPOE)	825	1741	858	1847	841	1794
T5(Imaze. 70g/haPOE)	892	1771	912	2082	902	1926
T6(Imaze. 80g/haPOE)	1016	2196	1029	2239	1022	2217
T7(Imaze.+Imazemox 50g/haPRE)	825	1711	851	1838	838	1775
T8((Imaze.+Imazemox 70g/haPRE)	1016	2314	1029	2403	1022	2359
T9((Imaze.+Imazemox 80g/haPRE)	1051	2363	1071	2405	1061	2384
T10((Imaze.+Imazemox 50g/haPOE)	988	2161	1016	2209	1002	2185
T11((Imaze.+Imazemox 70g/haPOE)	1068	2573	1092	2702	1080	2637
T12((Imaze.+Imazemox 80g/haPOE)	1101	2858	1118	2919	1110	2889
T13(Pendim.1000g/haPRE)	1057	2482	1078	2562	1068	2522
T14(Imaze.+Pendi.1000g/ha)	907	2007	926	2174	917	2091
T15(Hoeing twice)	921	2115	935	2205	928	2160
T16 (weedy check)	550	1698	580	1838	565	1768
S.Em±	46.70	139.30	74.07	128.83	53.85	104.49
CD=(0.05)	139.34	415.61	221.00	384.37	160.66	311.75
CV%	8.63	11.25	13.37	9.89	9.83	8.22

**Table 4:** Yield (Kg/ha) as influenced by weed management in mustard crop.

Treatments	Seed Yield			Straw Yield		
	2019-2020	2020-2021	Pool	2019-2020	2020-2021	Pool
T1(Imaze. 50g/haPE)	1217	1267	1242	2370	2594	2482
T2(Imaze. 70g/haPE)	1136	1216	1176	2199	2384	2292
T3(Imaze. 80g/haPE)	1100	1154	1127	2205	2344	2275
T4(Imaze. 50g/haPOE)	1097	1134	1115	2194	2339	2266
T5(Imaze. 70g/haPOE)	1134	1135	1134	2201	2316	2259
T6(Imaze. 80g/haPOE)	1164	1135	1150	2219	2334	2276
T7(Imaze.+ Imazamox 50g/haPE)	1100	1130	1115	2191	2296	2244
T8(Imaze.+ Imazamox 70g/haPE)	1169	1192	1180	2284	2368	2326
T9(Imaze.+ Imazamox 80g/haPE)	1184	1207	1195	2225	2399	2312
T10(Imaze.+ Imazamox 50g/haPOE)	1158	1159	1158	2209	2318	2264
T11(Imaze.+ Imazamox 70g/haPOE)	1225	1270	1247	2492	2554	2523
T12(Imaze.+ Imazamox 80g/haPOE)	1272	1357	1315	2678	2786	2732
T13(Pendim.1000g/haPE)	1189	1253	1221	2233	2491	2362
T14(Imaze.+ Pendim. 1000g/ha)	1097	1184	1140	2206	2365	2286
T15(Hoeing twice)	1156	1138	1147	2243	2340	2291
T16(weedy check)	1089	1127	1108	2192	2317	2255
S.Em±	74.44	77.83	49.94	172.58	160.00	150.91
CD=(0.05)	NS	NS	NS	NS	NS	NS
CV%	11.16	11.32	7.37	13.16	11.50	11.17

## Conclusion

- Imazethapyr + imazamox (RM) @ 80g/ha post emergence recorded maximum growth parameters plant height, dry matter, leaf area index, grain and straw yield of blackgram crop.
- Herbicides applied in blackgram had no residual phytotoxicity in succeeding mustard crop nor in soil.

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