



Bioefficacy of different herbicides in fenugreek

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Fenugreek (*Trigonella foenum-graecum* L.) locally known as ‘Methi’ in Hindi, is an important multi use leguminous spice crop of arid and semi-arid regions of India. India is the largest producer of fenugreek in the world where Rajasthan, Gujarat, Uttarakhand, Uttar Pradesh, Madhya Pradesh, Haryana and Punjab are the major fenugreek producing states. Rajasthan produces the lion’s share of India’s production, accounting for over 80% of the total fenugreek output (Anonymous 2012). In Haryana, the crop is sown in an area of 4978 ha with seed production of 13,973 tonnes (Anonymous 2009). Growth of fenugreek is very slow in the initial stage and it does not form a canopy that can suppress weed growth upto several weeks after sowing. Pendimethalin has been recommended to control weeds but its efficacy is for short period and is inconsistent. Weeds which come up after first irrigation also cause huge losses. Keeping it in view, present experiment was planned to study effectiveness of imazethapyr and its ready mix combination as pre-plant incorporation (PPI), pre-emergence (PE) or post-emergence applications (PoE).

Present study was conducted at vegetable research area of CCS, HAU, Hisar during *Rabi*, 2012-13. Experiment consisted of 10 herbicide treatments replicated thrice in a plot size of 7 x 3.6 m². Variety ‘HM 58’ was planted on 15th November, 2012 with a seed rate of 20 kg/ha. Herbicide pendimethalin at 1000 g/ha as PE, imazethapyr was used as PPI, PE at 80 g/ha and PoE at 2-4 leaf stage at 70 g/ha. Ready-mix combination of imazethapyr and imazamox was also applied as PoE at 2-4 leaf stage at 60 g/ha by using 750 litres of water/ha. Phytotoxic effect on crop was recorded at 60 DAS by using 0-100 scale. Visual weed control was also assessed at harvest on 0-100 scale. Data on weed dry weight was recorded at 60 DAS which was subjected to ANOVA for analysis.

To study residual effect of these herbicides on succeeding crops, after harvest of fenugreek, 2 lines each of cotton, bitter guard, okra and bottle gourd were planted on the same layout with slight disking of soil plots in May, 2017. Observations on plant height, number of leaves/plant and fresh biomass of succeeding crops was recorded at 30 DAS.

Table 1. Effect of different herbicide treatments on weed control and seed yield of fenugreek

Treatment	Dose (g/ha)	Time of application	Weed control (%) at harvest *	Weed dry weight(g/m ²) at 60 DAS**	Crop phytotoxicity (%) at 60 DAS	Seed yield (kg/ha)
Imazethapyr	80	PE	63.5(80)	2.9(7.7)	0(0)	1024
Imazethapyr + hoeing	80	PE	73.3(92)	1(0)	0(0)	1182
Imazethapyr	80	PPI	68.8(87)	3.2(9.6)	0(0)	1177
Imazethapyr + hoeing	80	PPI	79.5(95)	1(0)	0(0)	1237
Imazethapyr	70	PoE (2-4 LS)	49.7(58)	4.7(1.7)	24(16.7)	891
Imazethapyr + hoeing	70	PoE (2-4 LS)	60.5(75)	1(0)	22.6(15)	939
Imazethapyr + imazamox(RM)	60	PoE (2-4 LS)	55.7(68)	4.9(23.1)	28.6(23.3)	928
Imazethapyr + imazamox(RM)+hoeing	60	PoE (2-4 LS)	62.2(78)	1(0)	29.8(25.0)	961
Pendimethalin+ one hoeing	1000	PRE	76.2(92)	1.4(1.2)	46.9(53.3)	780
Two hoeings		30 and 60 DAS	75.2(93)	1(0)	0(0)	1318
Weed free			90(100)	1(0)	0(0)	1328
Weedy check			0(0)	(51.2)	0(0)	785
LSD (p=0.05)			8.3	0.72	4.82	189

PE = Pre-emergence; PPI = Pre-plant incorporation; PoE = Post-emergence application; LS = Leaf stage; DAS = Days after seeding;

*Arc sin transformed values. Actual values are in parenthesis, **($\sqrt{x+1}$) transformed values after analysis

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Table 2. Residual effect of different herbicides applied in fenugreek on succeeding crops

Treatment	No of leaves/plant					Fresh biomass (g/plant)					Plant height(cms)				
	Cotton	Okra	Black-gram	Bitter guard	Bottle gourd	Cotton	Okra	Black-gram	Bitter guard	Bottle gourd	Cotton	Okra	Black-gram	Bitter guard	Bottle gourd
Imazethapyr (80 g/ha) PE	3	5	7	3	6	8.5	12.4	7.6	7.3	16.3	10.4	12.4	10.4	9.3	22.9
Imazethapyr + hoeing (80 g/ha) PE	3	4	6	4	5	8.7	11.7	7.7	7.0	16.0	8.7	11.7	10.7	8.7	23.0
Imazethapyr (80 g/ha) PPI	4	4	8	3	5	9.6	10.9	9.3	6.9	15.9	9.3	12.0	11.3	9.0	23.5
Imazethapyr + hoeing (80 g/ha) PPI	3	3	9	3	6	8.9	10.3	8.9	7.4	15.7	8.4	11.4	10.9	8.8	23.0
Imazethapyr (70 g/ha) 2-4 LS	4	3	6	4	7	10.1	8.4	7.8	6.8	16.5	8.5	12.6	12.0	7.6	22.3
Imazethapyr + hoeing (70 g/ha) 2-4 LS	4	3	8	4	6	12.2	8.0	8.0	7.0	17.2	7.6	12.5	11.7	8.3	21.0
Imazethapyr + imazamox (RM) (60 g/ha) 2-4 LS	4	7	6	3	6	8.9	28.9	8.4	7.2	15.6	7.9	19.3	11.0	10.1	21.6
Imazethapyr + imazamox (RM) + hoeing (60 g/ha) 2-4 LS	3	6	9	4	7	9.2	32.3	8.2	7.6	17.0	8.3	20.5	11.5	8.7	21.7
Pendimethalin+ one hoeing (1000 g/ha) PE	7	8	8	4	6	30.0	32.4	7.6	8.2	17.6	16.7	21.0	10.5	7.6	22.0
Two hoeings 30 and 60 DAS	8	7	8	3	5	30.3	38.6	8.5	6.9	18.8	15.9	20.7	9.9	8.5	22.6
Weed free	7	8	9	3	6	28.4	37.1	9.4	7.4	21.7	17.0	22.0	10.9	8.9	24.3
Weedy check	7	7	7	4	5	29.2	35.3	9.0	7.8	22.4	17.6	22.4	12.0	8.4	33.8
LSD (p=0.05)	1.8	2.3	NS	NS	NS	3.1	5.4	NS	NS	NS	2.5	NS	NS	NS	NS

Experimental field was infested with broad-leaf weeds: *Chenopodium album*, *Chenopodium murale*, *Coronopus didymus*, *Melilotus indica* and *Rumex dentatus*. PE or PPI of imazethapyr at 80 g/ha either alone or in combination with one hoeing at 45 DAS provided 80-95% control of *C. album*, *C. murale*, *C. didymus* and *R. dentatus* without any adverse effect on fenugreek. PoE of imazethapyr at 70 g/ha or its ready mixture with imazamox (Odessey) although provided 58-78% control of weeds but caused suppression in crop growth with yield penalty of 28-33% as compared to weed free check. Kumar *et al.* (2016) also reported 58% control of weeds in fenugreek with PPI application of imazethapyr 55 g/ha. Excellent efficacy of this herbicide against broad-leaf weeds was also reported by Sikkema *et al.* (2005). PE of pendimethalin (standard check) at 1000 g/ha along with hoeing although gave 92% control of weeds but crop remained stunted even up to 80 DAS with seed yield of 780 kg/ha which was minimum among herbicide treatments which was 36.9% less than imazethapyr applied at 80 g/ha as PPI.

Residual effect of these herbicides applied in fenugreek was studied on succeeding bitter guard, blackgram, okra, cotton and bottle gourd. Post-emergence application treatments of imazethapyr + imazamox (RM) caused suppression in cotton and okra crops as evident from lesser plant height, number of leaves and fresh biomass of cotton in imazethapyr and imazethapyr + imazamox treated plots was significantly than pendimethalin, untreated and weed free check (**Table 2**). Ready-mix combination of imazethapyr + imazamox applied at 60 g/ha at 2-4 leaf stage did not cause any toxicity to

okra but to cotton. In urd bean, bitter guard and bottle gourd, no residual toxicity of any herbicide was observed.

SUMMARY

Pre-emergence or pre-plant incorporation of imazethapyr at 80 g/ha either alone or in combination with one hoeing at 45 DAS provided 80-95% control of *C. album*, *C. murale*, *C. didymus* and *R. dentatus* without any adverse effect on fenugreek. Post emergence application of this herbicide at 70 g/ha or its ready mixture with imazamox (Odessey) although provided 58-78% control of weeds but caused suppression in crop growth with yield penalty of 28-33% as compared to weed free check. Pre, PPI and post-emergence application treatments of imazethapyr and imazethapyr + imazamox (RM) caused suppression in cotton and okra crops. Crops blackgram, bottle gourd and bottle gourd were safe to grow after use of imazethapyr and its ready mix combination in fenugreek.

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