E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; SP-7(7): 653-657
Received: 06-06-2024
Accepted: 11-07-2024

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Integrated weed management in isabgol (*Plantago ovata* Forsk.)

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DOI: https://doi.org/10.33545/2618060X.2024.v7.i7Si.1162

Abstract
A field experiment entitled "Integrated weed management in isabgol (*Plantago ovata* Forsk.)". was carried out during *rabi* season of 2019-20 at the Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh. The experiment comprising nine treatments was laid out in randomized block design with three replications. The results revealed that next to the weed free treatment, significantly higher values of growth parameters *viz.,* plant height and plant spread, yield and yield attributes *viz.,* seed yield plant-1 and stover yield plant-1, seed yield, stover yield, test weight and harvest index were recorded with Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS followed by the treatment Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS. Besides, weed free condition, application of Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha post-emergence at 35-40 DAS followed by the treatment Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS were found more effective in reducing the weed population up to harvest and resulted in minimum dry weight of weeds, besides lower weed index and higher weed control efficiency and herbicidal efficiency index.

Keywords: Isabgol, hand weeding, herbicide, pre and post-emergence herbicide

Introduction
Isabgol (*Plantago ovata* Forsk.) is one of the most important medicinal plant which having foremost agriculture and commercial value in Indian economy. It belongs to the order Plantaginales, which consist of a single family Plantaginaceae. However, *Plantago ovata* is the only cultivated species in the country. Because of its bold seeds and easy husk separation. Indian *Plantago ovata* is preferred over European *Plantago* i.e. *P. psyllium* and *P. indica* (Trease and Evans, 1978) [13]. The seed husk of *P. ovata* is superior in terms of swelling qualities and colourlessness and also has better pharmaceutical and cosmetics importance. Therefore, it has replaced *P. psyllium* from the world market.

Isabgol, known as "Blond Psyllium" in English and "Shlakshnajira Shignabya" in Sanskrit. The name isabgol (*Plantago ovata* Forsk.) is derived from the two Persian words "Isab" and "Ghol" meaning horse's ear. This description fits well with the shape of the seeds, which resembles the horse's ear. *Plantago ovata* Forsk. by and large known as isabgol and locally as "Ghodajiru" or "Uthmujiru" in Gujarat.

Isabgol (*Plantago ovata* Forsk.) is an annual herb of about 30-45 cm height with usually four to five tillers arising from main stem. It has tap root system as in normal dicots. The plant has many linear leaves arranged acropetally on the tillers. Inflorescence is a spike with bisexual sessile flower crowded at the top of peduncle, which is borne at leaf axils. India is the largest producer and exporter of isabgol seed and husk, Indian isabgol husk is largely exported to USA, West Germany, UK, Canada and France. It is the highest earning medicinal crop. In India Isabgol is cultivated commercially in Gujarat, Rajasthan, Haryana, Punjab, Uttar Pradesh, Madhya Pradesh and Bihar. Gujarat commands near monopoly in the production and export of isabgol seeds and seed husk to the world market. In Gujarat, isabgol was cultivated in 10307 ha area with having 10688 MT production and 1.09 MT ha-1 productivity (Anon., 2020). Kutch, Banaskantha, Mehsana and Ahemedabad are major isabgol growing district in Gujarat.

At present, five varieties i.e. Guj.isabgol-1, Guj.isabgol-2, Guj.isabgol-3, Guj.isabgol-4 and Guj.isabgol-5 are available for cultivation in Gujarat.

Weed management is important aspect of isabgol productivity. It is responsible for 50% yield loss during early stage of crop growth. Weeds negatively impact crop yields, interfere with many crop production practices, and weed seeds can contaminate grain. Based on national research, corn and soybean yield can be reduced by approximately 50% without effective weed control. Herbicide application is the main weed control strategy used. Reliance on this one method has led to the development of herbicide-resistant weeds. There are a limited number of herbicides available to use and cases of herbicide resistance are rapidly increasing in the US. As a result, herbicides are in need of extra help to continue to ensure adequate weed control.

Integrated weed management tactics span a wide range of options and complexity. Many integrated weed management tactics can be integrated without substantial change to current management programs, while others require more extensive planning and implementation. Some options that are easier to implement include: equipment cleaning, timely scouting, altering herbicide tank mixes; while more extensive options include: changing crop rotation, cover cropping, changing tillage practices, and harvest time weed seed control.

Materials and Methods

The experiment entitled "Integrated weed management in isabgol (*Plantago ovata* Forsk.)" was conducted during *rabi* season of the year 2019-20. The experiment was conducted in C-6 plot of Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh during *rabi* 2019-20. Geographically, Junagadh is situated at 21.50 N latitude and 70.50 Elongitude with an altitude of 60 m above the mean sea level under South Saurashtra Agro-climatic region of Gujarat state and enjoys a typically subtropical climate characterized by fairly cold and dry winter, hot and dry summer and warm and moderately humid monsoon.

The rainy season commences in the first fortnight of June and ends by mid of September with an average rainfall of 1094 mm (average of last 10 years). January is the coldest month of winter. Summer season commences during the second fortnight of February and ends by middle of June. April and May are the hottest months of summer. Total rainfall received during crop growing season was 0.0 mm. The range of average sun shine, and evaporation was 3.2-9.1 h, and 3.1-7.6 mm, respectively. the soil of the experimental plot was clayey in texture and slightly alkaline in reaction with pH 8.1 and EC 0.65 dSm^{-1}. The soil was low in available nitrogen (235 kg/ha), medium in available phosphorus (42 kg/ha) and medium in available potash (275 kg/ha).

Proposed isabgol cultivar GI 4 is high yielding with better stability and more content of husk. Gujarat isabgol-4 variety developed by Research Scientist at Seed Spices Research Station, SDAU, Jagudan and released in the year 2016. Proposed variety is non shattering type with higher husk swelling trait. Cultivation of GI 4 is increased the income of 22.45 percent higher than GI 3. JI-09-21 was less prone to downy mildew as well as root rot diseases.

The experiment comprising of total nine treatments *viz.*, of T_1(Pendimethalin 900 g/ha as pre-emergence + HW at 40 DAS), T_2(Oxyfluorfen 125 g/ha as pre-emergence + HW at 40 DAS), T_3(Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS), T_4(Oxadiargyl 80 g/ha applied as a early post-emergence at 7 DAS), T_5(Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS), T_6(Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS), T_7(Oxyfluorfen 125 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS), T_8(Weed free) and T_9(Weedy check). The isabgol (cv. Gujarat Isabgol 4) was sown on 29th November 2019 at a spacing of 30 cm x 10 cm using seed rate of 3 kg/ha. The gross plot size was 5.0 m × 2.4 m and net plot size was 4.0m × 1.8 m. The crop was harvested at maturity on 21th March, 2020. At maturity, the leaves become yellowish and spikes turn brownish in colour which is confirmed by pressing a drying spike between 2 fingers when the mature seeds come out easily. The border lines were harvested first and it was removed from the experimental area. Then the net area was harvested separately.

In aspect of weed studies the observation on various parameters species wise weed count, dry weight of weed, weed index, weed control efficiency (%) and herbicidal efficiency index was recorded during experiment of research. The gross realization in terms of rupees per hectare will be worked out taking into consideration the fenugreek seed and straw yields from each treatment and local market prices. Net returns of each treatment will be calculated by deducting the total cost of cultivation from the gross returns. The benefit cost ratio (B:C) was calculated by dividing gross return with cost of cultivation.

Results and Discussion

The results revealed that different treatments manifested significant influence on growth and yield of isabgol (Table 1). Among the different weed management treatments, the (Weed free) T_8 higher plant height at harvest (36.33 cm) was recorded but, it was statistically at par with treatments T_5 (Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS) and T_6 (Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS). Treatment T_9 (Weedy check) recorded significantly the lowest plant height of (30.63 cm).

Treatment T_8 (Weed free) recorded significantly the highest plant spread (20.77 cm) but, it was statistically at par with treatments T_5 (Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS) and T_6 (Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS). Treatment T_9 (Weedy check) recorded significantly the lowest plant spread (15.00 cm).

Significantly higher seed yield per plant (4.47 g/plant) was recorded with treatment T_8 (Weed free) but, it was statistically at par with treatments T_5 (Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS) and T_6 (Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS). Treatment T_9 (Weedy Check) was found significantly inferior with respect to seed yield per plant (2.63 g/plant).

Significantly higher stover yield per plant (14.20 g/plant) was recorded with treatment T_8 (Weed free) but, it was statistically at par with treatments T_5 (Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS) and T_6 (Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS). Treatment T_9 (Weedy Check) was found significantly inferior with respect to stover yield (9.87 g/plant)

Treatment T_8 (weed free) recorded significantly higher seed yield (877 kg/ha), The corresponding seed yield of at par treatment was T_5 (Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS) and T_6 (Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS). Treatment T_9 (Weedy check) was found significantly inferior with respect to seed yield (515 kg/ha). Similar treatment as that of seed yield was observed in case of stover yield. Treatment T_8 (weed free) recorded significantly higher stover yield (2566 kg/ha), but it was statistically at par with treatments T_5 (Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS) and T_6 (Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS). Treatment T_9(Weedy check) was found significantly inferior with respect to stover yield (2008 kg/ha).

The higher values of growth parameters *viz*., plant height and plant spread were registered under treatments T_8 (weed free), T_5 (Pendimethalin 900 g/ha as pre emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS) and T_6 (Pendimethalin 900 g/haas pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS). These findings are in agreement with those of Meena and Mehta (2009) [6], Meena and Mehta (2010) [7], Gohil *et. al.* (2014) [3] and Mathukia *et. al.* (2018) [5].

Yield and yield attributes were enhanced under treatments T_8 (weed free), but it was found significantly at par with T_5 (Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS) and T_6 (Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post emergence at 35-40 DAS) which might be due to early season control of weeds by application of pre emergence herbicides and at later stage by post emergence herbicide as evidenced by less number of weed (Table 1 to 2) and dry weight of weeds (Table 1). This might have maintained high soil fertility status and moisture content by means of less removal of plant nutrients and water through weeds. Resultantly increased nutrients and water uptake by the crop leading to increased rate of photosynthesis.

Supply of photosynthates to various metabolic sinks might have favoured yield and yield attributes. The superiority of these treatments could be explained on the basis of better growth and higher uptake of nutrients under these practices might have produced more photosynthates and converted into numerous metabolites needed for yield and yield attributes. The lowest value of yield and yield attributes *viz*., grain yield plant-1, stover yield plant-1, seed yield and stover yield were observed under treatment T_9 (Weedy check). These findings are in close conformity with those reported by Yadav *et.al.* (2004) [15], Yadav *et.al.* (2011) [14], Gohil *et.al.* (2014) [3], Nalini *et.al.* (2017) [10] and Mathukia *et.al.* (2018) [5].

Table 1: Growth and yield of isabgol under different weed management treatments

Treatments		Plant Height (cm)	Plant Spread (cm)	Seed Yield Per Plant	Stover Yield Per Plant	Seed Yield (Kg/ha)	Straw Yield (Kg/ha)
T_1	Pendimethalin 900 g/ha as pre-emergence + HW at 40 DAS	32.83	18.30	3.37	12.27	759	2300
T_2	Oxyfluorfen 125 g/ha as pre-emergence + HW at 40 DAS	31.93	17.43	3.00	10.87	688	2241
T_3	Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS	32.50	18.13	3.07	12.00	700	2290
T_4	Oxadiargyl 80 g/ha applied as a early post-emergence at 7 DAS	31.07	15.73	2.77	10.30	661	2203
T_5	Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post- emergence at 35-40 DAS	35.30	20.20	4.30	13.70	853	2508
T_6	Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS	34.80	20.03	4.07	13.57	810	2460
T_7	Oxyfluorfen 125 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS	32.70	18.03	3.13	11.80	695	2279
T_8	Weed free	36.33	20.77	4.47	14.20	878	2566
T_9	Weedy check	30.63	15.00	2.63	9.87	515	2008
S.Em. ±		1.15	0.67	0.14	0.46	41	107
CD at 5%		3.44	2.02	0.42	1.38	124	320
C.V %		6.01	6.43	7.03	6.61	9.82	7.97

Different weed management treatments marked their significant effects on monocot, dicot and sedge weeds at harvest. Excluding the treatment weed free (T_8), significantly the lowest number of monocot weeds (5.33 weeds per m^2) was recorded under the treatment T_5 (Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS), which remained statistically at par with the treatment T_6 (Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS). Significantly the highest numbers of monocot weeds were (52.10 weeds per m) recorded under treatment T_9 (Weedy check).

Excluding the treatment weed free (T_8), significantly the lowest number of dicot weeds (7.93 weeds per m^2) was recorded under the treatment T_5 (Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS), which remained statistically at par with the treatment T_6 (Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS). Maximum numbers of dicot weeds (57.43 weeds per m^2) were recorded under treatment T_9 (Weedy check).

Next to the treatment weed free (T_8), significantly the lowest sedge weeds at harvest (26.67 weeds per m^2) were recorded under the treatment T_5 (Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS), which remained statistically at par with the treatment T_6 (Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS). Maximum numbers of sedge weeds (64.60 weeds per m^2) were recorded under T_9 (Weedy check).

The removal of weeds at regular interval through hand weeding accounted for less count of weeds under treatments of weed free (T_8). Treatment T_5 (Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS) and T_6 (Pendimethalin 900 g/ha as pre-emergence +

Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS) was found most effective by recording the lower weed population due to early season control of weeds by application of pre emergence herbicides and at later stage by post emergence herbicide. In addition to this, dense crop canopy might have smothering effect on weeds. Treatment weedy check (T_9) recorded significantly the highest weed population 30, 60 DAS and at harvest owing to unrestricted weeds growth. These results are in close accordance with those of Yadav *et.al.* (2004) [15], Roy *et.al.* (2010) [11], Fagaria *et.al.* (2014) [2] and Savaliya *et.al.* (2017) [12].

Dry weight of weed was significantly influenced by different weed management treatments. Except treatment T_8 (weed free), treatment T_5 (Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS) recorded significantly the lowest dry weight of weeds (99.00 kg/ha) at harvest. However, it was statistically at par with treatment T_6 (Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS). Conversely, significantly the highest dry weight of weeds (559.67 kg/ha) was observed under weedy check (T_9). In addition to this, dense crop canopy might have suppressed weed growth and ultimately less dry weight of weed. Treatment T_9 (Weedy check) recorded significantly the highest dry weight of weeds (559.67 kg/ha). This might be due to uncontrolled condition favoured luxurious weed growth leading to increased dry matter. The findings are in conformity with those reported Roy *et. al.* (2010) [11], Meena *et. al.* (2013) and Savaliya *et. al.* (2017) [12].

Among different treatments excluding weed free (T_8), the lowest WI of 2.85% was recorded under the treatment T_5 (Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS), closely followed by T_6 (Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS) and T_1 (Pendimethalin 900 g/ha as pre-emergence + HW at 40 DAS) with WI of 7.71% and 13.56% respectively. On the other hand the highest WI (41.32%) was recorded under the weedy check (T_9) because of greater weed competition stress. Similar findings were reported by Meena and Mehta (2009) [6].

The 100% WCE was observed under weed free (T_8). Among the weed management treatments, the highest WCE (82.31%) was registered under the treatment T_5 (Pendimethalin 900 g/haas pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS) closely followed by T_6 (Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS), T_1 (Pendimethalin 900 g/ha as pre-emergence + HW at 40 DAS), T_2 (Oxyfluorfen 125 g/ha as pre-emergence + HW at 40 DAS) and T_3 (Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS). On the other hand the lowest WCE (62.18%) was recorded under the treatment T_4 (Oxadiargyl 80 g/ha applied as an early post-emergence at 7 DAS), except the weedy check (T_9) with WCE of 0.00%. This might be due to lower dry weight of weed and weed index under these treatments. Similar findings were reported by Roy *et. al.* (2010) [11], Meena and Mehta (2010) [7], Fagaria *et. al.* (2014) [2] and Nalini *et. al.* (2017) [10].

Among the herbicidal treatments, the highest HEI (3.71%) was observed under the treatment T_5 (Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS), followed by T_6 (Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS). However, the lowest HEI (0.75%) was observed under the treatment T_4 (Oxadiargyl 80 g/ha applied as an early post-emergence at 7 DAS). This might be due to higher seed yield and lower dry weight of weed under these treatments. Similar findings were reported by Roy *et. al.* (2010) [11].

Table 2: Sedge, monocot, dicot weed count at harvest, dry weight of weeds (kg/ha), weed index, weed control efficiency, herbicidal efficiency index and economics of isabgol under different weed management treatments

Treatment	Dicot weed count per m^2	Monocot weed count per m^2	Sedge weed count per m^2	Dry weight of Weeds (kg/ha)	WI (%)	WCE (%)	HEI (%)	Net returs (Rs. /ha)	B: C Ratio
T_1	3.37 (10.90)	3.31 (10.50)	5.59 (30.90)	141	13.56	74.81	1.88	26348	1.83
T_2	3.48 (11.60)	3.48 (11.60)	5.71 (32.20)	154	21.61	72.54	1.22	21652	1.70
T_3	3.64 (12.73)	3.57 (12.27)	5.75 (32.73)	162	20.24	71.11	1.24	25690	1.92
T_4	4.19 (17.07)	4.24 (17.53)	6.42 (40.93)	212	24.65	62.18	0.75	23529	1.87
T_5	2.90 (7.93)	2.41 (5.33)	5.20 (26.67)	99	2.85	82.31	3.71	35161	2.17
T_6	3.13 (9.33)	2.73 (7.00)	5.35 (28.27)	123	7.71	78.08	2.61	32721	2.12
T_7	3.62 (12.60)	3.56 (12.17)	5.81 (33.40)	169	20.78	69.80	1.16	23593	1.79
T_8	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.00	0.00	100.00	-	26912	1.67
T_9	7.58 (57.43)	7.24 (52.10)	8.06 (64.60)	560	41.32	0.00	-	13733	1.53
S.Em.+	0.14	0.16	0.19	15	-	-	-		
CD at 5%	0.42	0.48	0.58	45	-	-	-		
C.V%	6.67	7.96	6.23	14.45	-	-	-		

The remarkable effect of different weed management treatments was found on gross returns, net returns and B: C ratio of isabgol. The data revealed that maximum gross return of Rs. 67108 ha^{-1} was recorded under weed free (T_8), followed by the treatments T_5 (Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS), while the maximum net return of Rs. 35161 ha^{-1} was realized with T_5 (Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS), followed by T_6 (Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post emergence at 35-40 DAS), while the maximum BCR of 2.17 and 2.12 was obtained with the treatment T_5 (Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha applied as a post-emergence at 35-40 DAS) and T_6 (Pendimethalin 900 g/ha as pre-emergence + Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS), respectively. The highest benefit under these treatments might have been due to less cost of herbicides and higher production. Similar, results are also reported by Mehriya *et. al.* (2007) [8], Nagar *et. al.* (2009) [9] and Savaliya *et. al.* (2017) [12].

Conclusion

On the basis of the results of the one year field study, it can be concluded that effective and economically viable weed management in isabgol under South Saurashtra Agro-climatic Zone can be achieved by application of Pendimethalin 900 g/ha as pre-emergence + Quizalofop ethyl 50 g/ha OR Oxadiargyl 80 g/ha applied as a post-emergence at 35-40 DAS. However, where farm labours are sufficient, crop can be kept weed free through hand weeding as and when required for effective control of weeds.

Acknowledgements

It is by the grace and will of the almighty that I have this great privilege to convey my regards and thanks to those who have helped and assisted me at different stages during my PG work and in the compilation of my research work. I express my heartfelt and sincere thanks to my affectionate and honorable all the staff members of Department of Agronomy and Department of Agricultural Chemistry and Soil Science, College of Agriculture, JAU, Junagadh for their ever willing co-operation and encouragement.

References

1. Anonymous. District wise area and production and yield of important food and non-food crops in Gujarat state. Directorate of Horticulture, Gandhinagar; c2020.
2. Fagaria VD, Gupta KC, Saxena R. Integrated weed management in fenugreek (*Trigonella foenum graceum* L.). Int J Agric Sci. 2014;10(1):302-304.
3. Gohil BS, Mathukia RK, Dobariya VK, Chhodavadia SK. Potential of weed seed bank dynamics and economic feasibility of weed management practices in rabi fennel (*Foeniculum vulgare* Mill.). World Res J Agric Sci. 2014;1(1):2-6.
4. Makavana PS. Integrated weed management in Coriander. M.Sc. (Agri.) Thesis. Junagadh Agricultural University, Junagadh, India; c2010.
5. Mathukia RK, Sagarka BK, Panara DN, Vekariya SJ. Management of diverse weed flora of cumin by sole and combined herbicide application. J Crop Weed. 2018;14(2):143-148.
6. Meena SS, Mehta RS. Integrated weed management in coriander (*Coriandrum sativum*). Indian J Agric Sci. 2009;79(10):824-826.
7. Meena SS, Mehta RS. Economic feasibility of weed management practices in cumin. Indian J Hortic. 2010;67:189-192.
8. Mehriya ML, Yadav RS, Jangir RP, Poonia BL. Nutrient utilization by cumin (*Cuminum cyminum*) and weed as influenced by different weed-control methods. Indian J Agron. 2007;52(2):176-179.
9. Nagar RK, Meena BS, Dadheech RC. Effect of integrated weed and nutrient management on weed density, productivity and economics of coriander (*Coriandrum sativum* L.). Indian J Weed Sci. 2009;41(1-2):71-75.
10. Nalini N, Sriniva A, Ramprakash T, Praveen Rao V. Weed management in ajwain. Int J Pure Appl Biosci. 2017;5(4):932-937.
11. Roy DK, Singh D, Sinha NK, Pandey DN. Weed management in coriander. Biennial Conference on Indian Society of Weed Science on Recent Advances in Weed Science Research; c2010. p. 118.
12. Savaliya DV, Patel TU, Patel DD, Arvadiya LK, Patel PS, Patel DK, *et al*. Weed management in coriander. AGRES-An Int eJ. 2017;6(1):142-146.
13. Trease GE, Evans WC. Pharmacognosy. 11th ed. Bailliere Tindall, A Division of Cassell and Collier, Macmillan Publishers Ltd., London; c1978.
14. Yadav A, Patel JC, Mehta RS, Meena T. Growth, yield and economics of cumin (*Cuminum cyminum* L.) production as affected by weed management practices. Agric Sci Digest. 2011;31(4):316-318.
15. Yadav RS, Sharma SK, Poonia BL, Dahama AK. Selectivity and phytotoxicity of oxadiargyl on cumin and weeds and its residual effect on succeeding mothbean and pearl millet. Indian J Weed Sci. 2004;36(1-2):83-84.