www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(9): 1666-1670

www.thepharmajournal.com
Received: 01-06-2022
Accepted: 04-07-2022

Sujan Singh Paikra
College of Agriculture and Research Station, Janjgir-Champa, IGKV, Raipur, Chhattisgarh, India

Vijay Kumar
Department of Vegetables Sciences, College of Agriculture, IGKV, Raipur, Chhattisgarh, India

Rajshree Gayen
Department of Vegetables Sciences, College of Agriculture, IGKV, Raipur, Chhattisgarh, India

Shrikant Chitale
Department of Agronomy, College of Agri culture, IGKV, Raipur, Chhattisgarh, India

RR Saxena
Department of Agriculture Statistics and Social Sciences, College of Agriculture, IGKV, Raipur, Chhattisgarh, India

Corresponding Author:
Sujan Singh Paikra
College of Agriculture and Research Station, Janjgir-Champa, IGKV, Raipur, Chhattisgarh, India

Effect of integrated weed management on growth, yield and quality in rabi onion (*Allium cepa* L.)

Sujan Singh Paikra, Vijay Kumar, Rajshree Gayen, Shrikant Chitale and RR Saxena

Abstract
The experiment was conducted at College of Agriculture and Research Station, Janjgir-Champa, IGKV, Raipur (C.G.) during *rabi* season 2016-17 and 2017-18 to find out the effect of integrated weed management on growth, yield and quality in rabi onion (*Allium cepa* L.). The 14 treatments comprised of pendimethalin @ 1.5 kg ha^{-1} as PE, pendimethalin @ 1.5 kg ha^{-1} as PE fb one hand weeding at 45 DAT, pendimethalin @ 1.5 kg ha^{-1} as PE fb fenoxaprop-p-ethyl 0.080 kg ha^{-1} as PoE at 45 DAT, oxyfluorfen @ 0.25 kg ha^{-1} as PE, oxyfluorfen @ 0.25 kg ha^{-1} as PE fb one hand weeding at 45 DAT, oxyfluorfen @ 0.25 kg ha^{-1} as PE fb fenoxaprop-p-ethyl 0.080 g ha^{-1} as PoE at 45 DAT, oxadiargyl @ 0.080 kg ha^{-1} as PE, oxadiargyl @ 0.080 kg ha^{-1} as PE fb one hand weeding at 45 DAT, oxadiargyl @ 0.080 kg ha^{-1} as PE fb fenoxaprop-p-ethyl 0.080 kg ha^{-1} as PoE at 45 DAT, propaquizofop 5% + oxyfluorfen 12% @ 0.15 kg ha^{-1} PE, pendimethalin @ 1.0 kg ha^{-1} PE fb propaquizofop 0.05 kg ha^{-1} PoE at 45 DAT, oxadiargyl @ 0.070 kg ha^{-1} PE fb propaquizofop 0.05 kg ha^{-1} PoE at 45 DAT, Two hand weeding at 20 and 50 DAT and weedy check. The experiment was laid out in randomized block design with three replications. Onion variety "Agrifound Light Red" was grown as a test crop.
The weed density and biomass of weeds were found minimum under two hand weeding at 20 and 50 DAT. All the herbicides treatments improved crop growth *viz*. plant height, Number of leaves, bulb yield quality parameter *viz*. dry weight of bulb TSS %, sulfure content in bulb, ascorbic content in bulb and reduced weed density and their weed biomass as compared to weedy check. Significantly highest bulb yield of onion (322.17 q ha^{-1}) was noted under hand weeding twice at 20 and 50 DAT, however, it was statistically followed by oxyfluorfen @ 0.25 kg ha^{-1} as PE fb one hand weeding at 45 DAT (291.95 q ha^{-1}), pendimethalin @ 1.5 kg ha^{-1}as PE fb one hand weeding at 45 DAT and oxadiargyl 0.080 kg ha^{-1} as PE fb one hand weeding at 45 DAT (285.66 q ha^{-1}). All these parameters were found minimum under weedy check.

Keywords: Onion, growth, bulb yield, quality. pre and post herbicides

Introduction
Onion (*Allium cepa* L.) is one of the most important vegetable crops grown throughout the world. According to Vavilov (1951), the primary center of origin lies in Central Asia. The near east and Mediterranean are the secondary centre of origin. Globally it is considered to be the second most important vegetable after tomatoes. Therefore, onion is popularly referred as 'Queen of the kitchen.
It is an indispensible item in every kitchen as vegetable. Onion bulb and green leaves both are rich in minerals, protein and ascorbic acid. The pungency in onion odour is formed by enzymatic reaction only when tissues are damaged. The pungency in onion is due to volatile oil as allyl-propyl disulphide. The colour of the outer skin of onion bulbs is due to quercetin.
The major onion producing countries are China, India, USA, Turkey, Japan, Iran, Pakistan, Spain and Brazil. India is the second largest producer of onion in the world and occupies 12.85 lakh hectares area under the cultivation with a production of 232.62 lakh tonnes and productivity of 18.10 t ha^{-1}. Maharashtra is leading state in area and production but in productivity Gujarat is the leading state followed by Haryana, Andhra Pradesh and Madhya Pradesh (Anonymous, 2018) [1].
Onion is short duration, shallow rooted bulb vegetable crop commonly cultivated throughout the India and it is more prone to weed menace and usually infested by wide spectrum of broad leaf and grassy weeds. Weeds are undesirable plants which compete with crop for available space, nutrients and water and thereby cause considerable losses in crop yield. The weeds infestation is problematic especially at early stage of crop growth.

The problem of weeds in onion is aggravated due its initial slow growth, shallow root system, heavy nutrients and farm yard manure application and frequent irrigations. Weeds compete with the crop for water, soil nutrient competitive ability with its initial slow growth and lack of adequate foliage makes onions weak against weeds. In addition, their cylindrical upright leaves do not shade the soil to block weed growth.

Weed infestation is the one of the limiting factors in quality bulb production in onion. Weed competition reduced the bulb yield of onion to the extent of 2.35 – 61.8 per cent depending upon the duration of crop weed competition and intensity (Sankar *et al* 2015) [14]. Removal of weeds through hand weeding method is laborious, costly and time consuming. This situation makes it necessary to use herbicides for effective and timely management of weeds in this crop. Proper and timely weed control measures are essential for good bulb development in onion. It is thus highly imperative to schedule suitable method of weed management by application of different herbicides for enhancing profits to onion growers of the country. It is essential to evaluate the effects of herbicides in weed control in onion that can have positive effects on development of onion crop.

Materials and Methods

The experiment carried out during the year 2016-17 and 2017-18 in rabi season at College of Agriculture and Research Station, Farm, Janjgir-Champa, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). Janjgir is situated in central parts of Chhattisgarh and lies at latitude, longitude and altitude of 22º1′ N, 82º39′ E and 253 meter above mean sea level, respectively. The experiment consists of 14 treatments *viz*. T_1: pendimethalin @ 1.5 kg ha^{-1} as PE, T_2: pendimethalin @ 1.5 kg ha^{-1}as PE fb one hand weeding at 45 DAT, T_3: pendimethalin @ 1.5 kg ha^{-1} as PE fb fenoxaprop-p-ethyl 0.080 kg ha^{-1} as PoE at 45 DAT, T_4: oxyfluorfen @ 0.25 kg ha^{-1} as PE, T_5: oxyfluorfen @ 0.25 kg ha^{-1} as PE fb one hand weeding at 45 DAT, T_6: oxyfluorfen @ 0.25 kg ha^{-1} as PE fb fenoxaprop-p-ethyl 0.080 kg ha^{-1} as PoE at 45 DAT, T_7: oxadiargyl 0.080 kg ha^{-1} as PE, T_8: oxadiargyl @ 0.080 kg ha^{-1} as PE fb one hand weeding at 45 DAT, T_9: oxadiargyl @ 0.080 kg ha^{-1} as PE fb fenoxaprop-p-ethyl 0.080 kg ha^{-1} as PoE at 45 DAT, T_{10}: propaquizofop 5% + oxyfluorfen 12% @ 0.15 kg ha^{-1} PE, T_{11}: pendimethalin @ 1.0 kg ha^{-1} PE fb propaquizofop 0.05 kg ha^{-1} PoE at 45 DAT, T_{12}: oxadiargyl @ 0.070 kg ha^{-1}PE fb propaquizofop 0.05 kg ha^{-1} PoE at 45 DAT, T_{13}: Two hand weeding at 20 and 50 DAT and T_{14}: Weedy check. The experiment was laid out in Randomized Block Design with three replications. Onion variety "Agrifound Light Red" was grown as a test crop. Onion was transplanted 1st December 2016 and 2nd December 2017 with spacing 15x10 cm. The crop was fertilized with 75, 60 and 100, N_2, P_2O_5 and K_2O kg ha^{-1}, respectively. Whole quantity of phosphorus and potash were applied as basal before transplanting and nitrogen in two equal splits 50% as basal and 50% as top dressing 3o days after transplanting. The pre-emergence herbicides were sprayed within 48 hours after transplanting of seedlings by knapsack sprayer using flat fan nozzle with 600 liter of water and post-harvest emergence as per treatments were applied at 45 DAT. Other packages of practices were followed as per recommendations made for the onion crop. Growth, yield and quality parameters were recorded from each plot by randomly selected five plants and same were used for analyzing purpose.

Result and Discussion

Effect on growth, Yield and quality parameters

The data presented on growth parameters in onion (Table.1) revealed significant variations among the treatments. Significantly highest pooled plant height was recorded in two hand weeding at 20 and 50 DAT (58.36 cm) followed by oxyfluorfen @ 0.25 kg ha^{-1} as PE fb one hand weeding at 45 DAT (56.83 cm), pendimethalin @ 1.5 kg ha^{-1} as PE fb one hand weeding at 45 DAT (56.55 cm) and oxadiargyl 0.080 kg ha^{-1} as PE fb one hand weeding at 45 DAT (55.97 cm). Significantly minimum pooled plant height of (42.88 cm) was observed in weedy check plots. Similar trend was also recorded in pooled number of leaves $plant^{-1}$ significantly maximum in two hand weeding at 20 and 50 DAT (7.38) followed by T_5 (7.20, T_2 (6.18) and T_8 (6.88). However, minimum Number of leaves $plant^{-1}$ was observed in weedy check (4.85). Significant variation observed in pooled pseudostem length and pseudostem diameter maximum were in two hand weeding at 20 and 50 DAT (8.34 cm) and (7.18 cm) which were significantly at par with oxyfluorfen @ 0.25 kg ha^{-1} as PE fb one hand weeding at 45 DAT, pendimethalin @ 1.5 kg ha^{-1} as PE fb one hand weeding at 45 DAT and oxadiargyl 0.080 kg ha^{-1} as PE fb one hand weeding at 45 DAT. Minimum were recorded in weedy check.

All the treatments significantly increased the plant height, number of leaves, pseudostem length and pseudostem diameter over weedy check because the increase in plant height number of leaves, pseudostem length and pseudostem diameter could be attributed to maximum utilization of sun light by onion due to minimum competition from weeds and availability of space and nutrients to crop. Similar results were reported by Manjunatha *et al.* (2005) [6], Yumnam *et al*. (2009) [20] and Minz *et al*. (2018) [7] in onion.

Data presented in (Table 2) revealed that maximum pooled bulb yield kg $plot^{-1}$ was obtained in two hand weeding at 20 and 50 DAT (29.04 kg $plot^{-1}$) closely followed by T_5 (26.27 kg $plot^{-1}$), T_2 (25.99 kg $plot^{-1}$) and T_8 (25.70 kg $plot^{-1}$). Significantly highest total bulb yield was recorded in two hand weeding at 20 and 50 DAT (322.17 q ha^{-1}) followed by T_5 (291.95q ha^{-1}), T_2 (288.77q ha^{-1}), and T_8 (285.66 q ha^{-1}) than the rest of treatments. It might be due to less weed crop competition throughout crop growth period by manual weeding, which in turn maintain the soil fertility status by way of removing less plant nutrients through weeds and ultimately have favorable effect on crop growth parameter and yield attributes Yumnam *et al.* (2009) [20], Bharathi *et al.* (2011) [2] Tripathy *et al*. (2013) [16] and Sahoo *et al.* (2017) [13]. However, significantly lowest pooled total bulbs yield 101.35 q $ha^{-1}$was recorded in weedy check as the presences of more weed which interfered with growth and development of the crop and compete for the nutrients, moisture, light and space. The similar results were reported by Vashi *et al.* (2011) [17], Patel *et al*. (2011) [9] and Thakare *et al*. (2018) [15].

Maximum pooled Marketable bulb yield and % Marketable yield were obtained in T_{13} (290.85 q ha^{-1} and 90.43%) followed by T_5 (263.66 q ha^{-1} and 90.30%), T_2 (259.15and 89.74%) and T_8 (252.71q ha^{-1} and 88.46%). Which were significantly at par with each other However, minimum bulb yield kg $plot^{-1}$, Marketabl bulb yield q ha^{-1} and % Marketable yield of bulbs recorded in weedy check (35.92 q ha^{-1} and 35.56%).

The enhancement in marketable bulb yield under hand weeding and integrated weed management treatments is attributed to increases in yield of Grade A and B bulbs as compared weedy check. Grading of bulb into different grades according to their size is facilitated to the grower to fetch optimum price of the produce in the market. Among the distinct grades A and B grade bulb are suitable for marketing while grade C bulbs are unfit for marketing.

The above finding is in close proximity of Panse *et al*. (2014) [8], revealed that application of DOGR recommended practices oxyfluorfen 23.5% before planting + one hand weeding at 40-60 DAT marketable yield (249.05 q ha^{-1}).

Data presented in (Table 3) revealed that maximum pooled Dry weight of bulb (g**)** was obtained in T_{13} (12.38 g) closely followed by T_5 (12.12 g), T_2 (11.90 g) and T_8 (11.87). Maximum total soluble solids in onion was recorded in two hand weeding at 20 and 50 DAT (T_{13}) (12.52 Brix^0) followed by oxyfluorfen @ 0.25 kg ha^{-1} as PE fb one hand weeding at 45 DAT (12.44 Brix^0) and pendimethalin @ 1.5 kg ha^{-1}as PE fb one hand weeding at 45 DAT (12.37 Brix^0 which were at par with each other. Minimum TSS was recorded in weedy check. Maximum TSS was recorded under two hand weeding at 20 and 50 DAT. This might be due to effect of dryness during the growing period of the crop and higher temperature which led to accumulation of more total soluble solid. Whereas, in weedy check plots the microclimate was different as compared to weed free plots where crop was less subjected to dryness and more humid condition that resulted in low accumulation of TSS content in the bulbs.

The above finding is in close proximity of Minz *et al.* 2018 [7] who reported that TSS was the highest (13.20 Brix^0) in hand weeding and pre emergence of application of pendimethalin @1.0 kg ha^{-1} immediately after transplanting TSS (12.53 Brix^0).

Maximum value of sulphur content in bulb was under two hand weeding at 20 and 50 DAT (T_{13}**)** (8.32%) followed by (T_5) (8.23%) and (T_2) (8.15%) which were statistically at par with rest of treatments. However these were at par with (T_8) (8.13%), (T_3) (6.93%) and (T_6) (6.92%). Minimum sulphur content of onion bulb was recorded in weedy check (T_{14}) (6.23%).

The improvement in sulfure content in the bulbs under two hand weeding at 20 and 50 DAT and herbicide together with one hand weeding at 45 DAT might be due to good vegetative growth of plants and bulb development due to enhancement in nutrient uptake. These results are also in conformity with the findings of Singh *et al.* (1995) and Anwar *et al.*, (2001).

maximum total ascorbic acid content in onion was recorded in two hand weeding at 20 and 50 DAT (T_{13}) (11.65%) followed by oxyfluorfen @ 0.25 kg ha^{-1} as PE fb one hand weeding at 45 DAT (T_5) (11.17%) and pendimethalin @ 1.5 kg ha^{-1}as PE fb one hand weeding at 45 DAT (T_2) (10.96%) which were statistically at par with rest of treatments. However these were at par with (T_8) (10.88%) followed by (T_3) (10.58%) and (T_6) (10.56%). Minimum ascorbic acid content was recorded in weedy check.

Table 1: Effect of weed management on growth parameters in onion

Treatments	Plant height (cm)			No. of leaves			Pseudostem length (cm)			Pseudostem diameter (cm)		
	2016-17	2017-18	Pooled	2017-18	2016-17	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
T_1	47.77	47.43	47.60	6.30	5.93	6.11	7.13	7.10	7.11	5.40	5.27	5.33
T_2	57.00	56.10	56.55	7.43	6.93	7.18	8.37	8.27	8.32	6.87	6.83	6.85
T_3	49.73	48.40	49.06	7.23	6.13	6.68	7.23	7.22	7.23	5.67	5.90	5.78
T_4	47.50	47.67	47.58	6.47	6.00	6.23	6.90	7.10	7.00	5.23	5.37	5.30
T_5	57.33	56.33	56.83	7.50	6.90	7.20	8.36	8.33	8.34	7.03	6.90	6.96
T_6	49.47	49.67	49.57	6.37	6.33	6.35	7.33	7.10	7.22	5.97	5.80	5.88
T_7	47.67	47.83	47.75	6.17	6.12	6.14	6.90	7.00	6.95	5.33	5.23	5.28
T_8	56.37	55.57	55.97	6.80	6.97	6.88	8.30	8.23	8.26	6.77	6.73	6.75
T_9	49.17	48.43	48.80	6.57	5.97	6.27	7.23	7.20	7.21	5.47	5.50	5.48
T_{10}	48.27	47.33	47.80	6.40	6.17	6.28	7.03	7.13	7.08	5.40	5.47	5.43
T_{11}	48.23	48.70	48.46	6.97	5.63	6.30	7.20	7.07	7.13	5.70	5.47	5.58
T_{12}	48.10	49.50	48.80	6.67	5.70	6.18	7.23	7.17	7.20	5.60	5.50	5.55
T_{13}	58.33	58.40	58.36	7.63	7.13	7.38	8.37	8.33	8.35	7.13	7.23	7.18
T_{14}	42.53	43.23	42.88	5.17	4.53	4.85	4.50	4.47	4.48	3.43	3.90	3.66
SEM-+	0.70	0.95	0.82	0.26	0.27	0.26	0.16	0.12	0.14	0.18	0.12	0.15
CD 5%	2.02	2.77	2.39	0.75	0.79	0.77	0.45	0.33	0.39	0.53	0.35	0.44

PE-Pre emergence, PoE- Post emergence, DAT-Days after transplanting, HW- hand weeding, fb-followed by

Table 2: Effect of weed management on Bulb yield kg $plot^{-1}$, bulb yield, Marketable yield (q ha^{-1}), and % Marketable yield parameters in onion

Treatments	Bulb yield kg $plot^{-1}$			Bulb yield (q ha^{-1})			Marketable yield (q ha^{-1})			% Marketable yield		
	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
T_1	19.23	19.67	19.45	213.67	218.56	216.11	172.22	175.55	173.88	80.60	80.32	80.46
T_2	26.04	25.94	25.99	289.33	288.22	288.77	260.77	257.54	259.15	90.12	86.35	89.74
T_3	23.79	24.72	24.25	264.33	274.67	269.50	228.88	225.55	227.21	86.58	82.12	84.35
T_4	19.11	19.23	19.17	212.33	213.67	213.00	167.77	172.21	169.99	79.01	80.59	79.80
T_5	26.25	26.30	26.27	291.67	292.23	291.95	263.33	264.00	263.66	90.28	90.33	90.30
T_6	24.24	24.07	24.15	269.33	267.44	268.38	227.34	226.67	227.00	84.40	82.75	83.56
T_7	18.84	18.69	18.76	209.33	207.67	208.50	165.55	170.99	168.27	79.08	82.33	80.70
T_8	25.94	25.47	25.70	288.33	283.00	285.66	255.55	249.88	252.71	88.63	88.29	88.46
T_9	23.88	23.97	23.92	265.33	266.33	265.83	228.32	225.54	226.93	86.05	84.68	85.36
T_{10}	19.23	19.29	19.26	213.67	214.33	214.00	175.33	172.22	173.77	82.05	80.35	81.20
T_{11}	23.91	23.99	23.95	265.67	266.56	266.11	229.99	220.43	225.21	85.57	82.95.	85.86

T_{12}	23.17	23.16	23.16	257.44	257.34	257.39	215.66	216.65	216.15	83.77	84.18	83.97
T_{13}	29.04	28.95	28.99	322.67	321.67	322.17	291.50	291.20	290.85	90.33	90.52	90.43
T_{14}	9.30	9.16	9.23	103.33	100.37	101.35	35.50	36.34	35.92	34.35	36.78	35.56
SEM-+	0.21	0.25	0.23	2.45	0.80	1.63	0.62	1.13	0.87	-	-	-
CD 5%	0.62	0.72	0.67	7.13	2.32	4.73	1.78	3.27	2.52	-	-	-

PE-Pre emergence, PoE- Post emergence, DAT-Days after transplanting, HW- hand weeding, fb-followed by

Table 3: Effect of weed management on Sulfur content in bulbs Dry weight of bulb (g), Ascorbic acid content in bulbs, Total Soluble Solid and need control efficiency parameters in onion

Treatments	Sulfur content in bulbs (%)			Dry weight of bulb (g)			Ascorbic acid content in bulbs (%)			Total Soluble Solid (T.S.S. Brix)			Weed control efficiency (%)		
	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
T_1	6.68	6.60	6.64	9.25	9.30	9.27	10.08	9.83	9.95	11.47	11.83	11.65	54.94	54.17	54.56
T_2	8.25	8.05	8.15	11.83	11.97	11.90	11.16	10.77	10.96	12.13	12.60	12.37	89.68	89.28	89.48
T_3	6.95	6.88	6.93	9.60	9.77	9.68	10.57	10.60	10.58	11.97	12.50	12.24	75.43	74.90	75.17
T_4	6.64	6.45	6.55	9.30	9.10	9.20	9.40	9.83	9.61	11.70	11.27	11.49	56.00	55.68	55.84
T_5	8.35	8.10	8.23	12.0	12.23	12.12	11.07	11.27	11.17	12.70	12.17	12.44	89.66	89.62	89.64
T_6	7.10	6.73	6.92	9.90	9.30	9.60	10.63	10.50	10.56	12.17	11.83	12.00	75.51	75.48	75.50
T_7	6.55	6.42	6.49	9.17	9.13	9.15	9.50	9.67	9.58	11.07	11.70	11.39	55.11	54.55	54.83
T_8	8.23	8.03	8.13	11.80	11.93	11.87	11.07	10.70	10.88	12.30	11.87	12.09	89.69	89.07	89.38
T_9	6.90	6.80	6.85	9.57	9.37	9.47	10.47	10.57	10.52	12.10	11.87	11.99	64.11	63.88	64.00
T_{10}	6.76	6.72	6.74	9.23	9.27	9.25	10.34	9.87	10.10	12.07	11.26	11.67	55.85	55.51	55.68
T_{11}	6.97	6.71	6.84	9.40	9.43	9.41	10.16	10.23	10.19	11.80	12.03	11.92	63.80	62.87	63.34
T_{12}	6.87	6.77	6.82	9.37	9.40	9.38	10.20	10.33	10.26	11.87	11.77	11.82	64.28	64.09	64.18
T_{13}	8.43	8.20	8.32	12.33	12.43	12.38	11.71	11.60	11.65	12.57	12.47	12.52	95.66	95.68	95.67
T_{14}	6.21	6.25	6.23	6.17	6.20	6.18	8.63	8.30	8.46	9.83	10.30	10.07	-	-	-
SEM-+	1.23	1.20	1.22	0.17	0.23	0.20	0.44	0.34	0.39	0.29	1.12	0.71	-	-	-
CD 5%	3.58	3.50	3.54	0.48	0.68	0.58	1.29	0.97	1.13	0.84	3.24	2.04	-	-	-

PE-Pre emergence, PoE- Post emergence, DAT-Days after transplanting, HW- hand weeding, fb-followed by

Effect on weeds: The experimental field was infested with mixed flora of dicot and monocot weeds, such as *Parthenium hysterophorus, Chenopodium album, Cyperus rotundus, Cynodon dactylon, Melilotus indica and Medicago denticulata* were the predominant weeds. At initial period of crop growth, broad leaf weeds contributed more as compared to grasses and sedges. (Table. 3) Significantly maximum weed control efficiency were registered in two hand weeding at 20 and 50 DAT (95%) followed by oxyfluorfen @ 0.25 kg ha^{-1} as PE fb one hand weeding at 45 DAT (89.64%), pendimethalin @ 1.5 kg ha^{-1} as PE fb one hand weeding at 45 DAT (89%) and oxadiargyl 0.080 kg ha^{-1} as PE fb one hand weeding at 45 DAT (89.38%). These results might be due to owing to less weed density and production of biomass by weeds in the treated plots. This is attributed to the effective control of weeds under these treatments, which reflected on less number of weeds and ultimately lower weed biomass. The weedy check recorded the highest weed biomass of weeds and the lowest weed control efficiency, where is due to uncontrolled condition favored luxurious weed growth leading to increased weed biomass accumulation. The finding was in conformity with those reported by Channappagour and Biradar (2017) [3], Bharathi *et al*. (2011) [2] and Vishnu *et al*. (2015) [18].

These may be due to the reason that application of initial pendimethelin, oxyflorfen and oxadiargyl control the germination of weed seeds satisfactorily. In integrated weed management practices at 45 DAT control the weed flora completely. There was less competition from weeds was observed with the crop among the integration of herbicides. Among the combined application of herbicide, pendimethalin @ 1.50 kg ha^{-1} PE fb fenoxaprop-p-ethyl 0.080 kg ha^{-1} as PoE at 45 DAT and oxyfluorfen @ 0.25 kg ha^{-1} as PE fb fenoxaprop-p-ethyl 0.080 kg ha^{-1} as PoE at 45 DAT gave satisfactory results in comparison with other combined applications.

Pre and post application of herbicides was found to be more effective than sole application which confirms integrated weed management as better alternative herbicides for suppressing the different weed flora integration of hand weeding. The result may be attributed to higher persistence of the herbicides in the soil there by suppressing the weed flora for longer duration resulting in less crop weed competition and for this reason higher bulb yield was obtained. Hence the treatment recorded highest bulb yield than other treatments.

The finding revealed that two hand weeding at 20 and 50 DAT recorded the highest bulb yield, gross and net return, whereas, benefit cost ratio were maximum in oxyfluorfen @ 0.25 kg ha^{-1} as PE fb one hand weeding at 45 DAT followed by pendimethalin @ 1.5 kg ha^{-1} as PE fb one hand weeding at 45 DAT. All the above treatments were comparable with regards to bulb yield, net return and benefit cost ratio. The use of pre and post-emergence herbicides was found profitable for getting higher yield and economic returns due to effective weed management. Application of oxyfluorfen @ 0.25 kg ha^{-1} PE was found superior growth and yield parameters of onion. The next superior integrated weed management treatment pendimethalin @ 1.5 kg ha^{-1}as PE fb fenoxaprop-p-ethyl 0.080 kg ha^{-1}as PoE at 45 DAT was for increasing yield could be opted as economy under condition of non-availability of labour.

Reference

1. Anonymous. Area, production and Productivity. Directorate Horticulture, Ministry of Agriculture, Government of Chhattisgarh Raipur, (C.G.); 2018.

2. Bharathi S, Rao AS, Kumari SS. Effect of weed management practices on weed control and yield of onion (*Allium cepa* L). J Res. Angrau. 2011;39(1&2):10-13.
3. Channappagoudar B, Biradar NR. Physiological studies on weed control efficiency in direct sown onion. Karnataka J Agric. Sci. 2007;20(2):375-376.
4. Chopra N, Chopra NK. Production of weed free mother bulb of onion through integration of herbicides and weeding. Indian Journal of Agronomy. 2007;52(1):80-82.
5. Kalhapure AH, Shete BT. Integrated weed management in onion. Indian Journal of Agronomy. 2012;58(3):408-411.
6. Manjunatha R. Integrated weed management in transplanted onion (*Allium cepa* L.) under irrigated alfisol. M.Sc. (Ag.) thesis, University of Agriculture Science, Dharwad; 2005.
7. Minz A, Horo P, Barla S, Upasani RR, Rajak R. Herbicides effect on growth, yield and quality of onion. Indian Journal of Weed Science. 2018;50(2):186-188.
8. Panse R, Gupta A, Jain PK, Sasode DS, Sharma S. Efficacy of different herbicides against weed flora in onion (*Allium cepa* L.). Journal of Crop and Weed. 2014;10(1):163-166.
9. Patel TU, Patel CL, Patel D, Thanki JD, Patel PS, Jat RA. Effect of weed and fertilizer management on weed control and productivity of onion (*Allium cepa* L.). Indian J Agron. 2011;56(3):267-272.
10. Rathod AD, Solanki RM, Modhavadia JM, Padmani DR. Efficacy of pre-and post–emergence herbicides in onion and their carry over effect on the succeeding crops. Ann. Agric. Res. New series. 2014;35(2):209-216.
11. Sable PA, Kurubar AR, Hugar A. Effect of weed management practices on weed control and nutrient in onion (*Allium cepa* L.). Asian Journal of Horticulture. 2013;8(2):444-447.
12. Sahoo BB, Tripathy P. Efficacy of herbicides against weed flora in onion (*Allium cepa* L.). Journal of Crop and Weed. 2019;15(1):158-163.
13. Sahoo SK, Choudhary S, Soren, Mishra C, Sahoo BB. Effect of weed manage-ment on growth and yield of onion (*Allium cepa* L.). Journal of Crop and Weed. 2017;13(2):1-4.
14. Sankar V, Thangasamy A, Lawande KE. Weed management studies in onion (*Allium cepa* L.) cv. N2-4-1 during rabi season. IJTA serials. 2015;33(02):627-631.
15. Thakare SS, Chirde PN, Shinhrup PV, Deshmukh JP, Kakde SU, Gholap AN. Weed management in onion by pre and post-emergence herbicides. Int. J Curr. Microbiol. App. Sci. Special. 2018;6:2197-2202.
16. Tripathy P, Sahoo B, Patel D, Dash DK. Weed management studies in onion (*Allium cepa* L.). J Crop and Weed. 2013;9(2):210-212.
17. Vashi JM, Pandya HV, Naik RM. Study on physical and chemical methods of weed control in onion crop. Int. J Plant Protection. 2009;2(2):245-247.
18. Vishnu V, Asodariya KB, Suthar A, Meena DK. Effect of herbicides on phytotoxicity and weed reduction in rabi onion (*Allium cepa* L.). Trends in Bio Sciences. 2014;7(23):4011-4015.
19. Warade AD, Gonge VS, Jogdande ND, Ingole PG, Karunakat AP. Integrated weed management in onion. Indian J Weed Sci. 2006;38(1 & 2):92-95.
20. Yumnam A, Mandal AR, Thapa U, Maity TK, Bhattacharya SP. Studies on weed management in onion (*Allium cepa* L.). Journal of Crop and Weed Science. 2009;5(1):325-326.