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Effect of new generation herbicides on growth attributing characters in Phule Samarth variety of *kharif* onion (*Allium cepa* L.)

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Abstract
A field experiment was conducted during *kharif* 2021 on Seed Cell Unit, 'F' Block, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra). The experiment was laid out in randomized block design with three replications. The experiment consisted of oxyflourfen, pendimethalin as pre emergence herbicides and Quizalofop ethyl and Ready mix Propaquizafop + Oxyflourfen as post emergence herbicides and their combination thus forms 10 treatments along with unweeded check (control). At 28 DAT plant height and number of leaves gives non-significant response to different weed management treatments. Treatment T9 Weed free check (2 Hand weeding at 20 and 40 DAT) recorded significantly maximum plant height (cm) and number of leaves at 56, 84 and at harvest. Treatment T9 Weed free check (2 Hand weeding at 20 and 40 DAT) recorded significantly maximum neck thickness (cm) and dry matter plant^{-1} (g) at 28, 56, 84 DAT and at harvest and minimum plant height, number of leaves, neck thickness and dry matter plant^{-1} was recorded significantly minimum in treatment T10 Unweeded check (control).

Keywords: *Kharif* onion, weed, herbicides

1. Introduction
The onion (*Allium cepa* L.) (2n = 16) belongs to the Alliaceae family and is one of the most important bulbous vegetable crops. It is most widely grown and popular VEGETABLE crops. It is most widely grown and popular vegetable crop among the alliums, globally it is considered to be the second most important vegetable after tomatoes. It is an indispensible item. Apart from furnishing nutrition, it also provides relishing flavours to our diets. Therefore, onion is popularly referred as "Queen of the kitchen" (Sangha and Baring, 2003) [5]. Weed is one of the most important yield reducing factors all over the world. It is called a silent killer of crop (Sathya Priya *et al*., 2017) [9]. Unlike most crops, onion has very poor competitive ability with weeds due to its inherent characteristics, such as shallow root system, narrow leaf and small leaf area index, and slow plant development (Sahoo *et al*., 2017) [8]. Uncontrolled weed growth caused 49 to 86 percent reduction in bulb yield of onion compared with the best herbicidal treatment (James and Harlen, 2010) [3]. The predominant weed flora that hampers the growth and yield of crop vary with soil type, moisture, and other climatic factors. Hence, it is essential to control weeds in order to ensure proper crop growth, especially in the early growth period. Hand weeding in onion is a common practice in India, but it is a tedious, expensive and time consuming task due to closer spacing and shallow root system. Non availability of labours during critical period of crop makes hand weeding difficult leading to heavy yield losses. The critical period of crop-weed competition in onion lies between 15-60 days after transplanting (Singh and Singh, 1994) [10]. Chemical weed control is a better supplement to conventional methods and forms an integral part of the modern crop production. Thus, use of herbicide is one of the alternatives left with the farmers to eliminate crop weed-competition at early growth stage of crop.

2. Material and Methods
The field experiment has been conducted during *kharif*, 2021-22 at Seed Cell Unit, 'F' Block MPKV, Rahuri to assess the effect of integrated weed management on growth and yield of *kharif* onion. There were ten treatments laid out in randomized block design (RBD) with three replications. The experiment consists of ten treatments *viz*., T1 Oxyflourfen 23.5% EC (PE)

@ 100 g a.i./ha.; T_2 Pendimethalin 38.7% CS (PE) @ 677.25 g a.i./ha.; T_3 Oxyflourfen 23.5% EC (PE) @ 100 g a.i/ha. fb Hand weeding 40 DAT; T4 Pendimethalin 38.7% CS (PE) @ 677.25 g a.i/ha. fb Hand weeding 40 DAT; T_5 Oxyflourfen 23.5% EC (PE) @ 100 g a.i/ha. fb Quizalofop ethyl (PoE) 5% EC @ 37.5 g a.i/ha at 30 DAT; T_6 Pendimethalin 38.7% CS (PE) @ 677.25 g a.i/ ha. fb Quizalofop ethyl (PoE) 5% EC @ 37.5 g a.i/ha at 30 DAT; T_7 Oxyflourfen 23.5% EC (PE) @ 100 g a.i/ha. fb Ready mix Propaquizafop 5% EC + Oxyflourfen 12% EC (43.75 +105) g a.i/ha at 30 DAT; T8 Pendimethalin 38.7% CS (PE) @ 677.25 g a.i/ha. fb Ready mix Propaquizafop 5% EC + Oxyflourfen 12% EC (43.75 +105) g a.i/ha at 30 DAT; T_9 Weed free check (2 Hand weeding at 20 and 40 DAT) and T_{10} unweeded check (control).

2.1 Plant height (cm)
It was measured of five plant from each plot from the base of the plant to the tip of the longest leg at 28, 56, 84 DAT and at harvest.

2.2 Number of leaves plant^{-1}
Number of leaves plant was recorded at 28, 56, 84 DAT and at harvest from the same plant which were selected and tagged for observation.

2.3 Neck thickness (cm)
Neck thickness was recorded at 28, 56, 84 DAT and harvest with the help of vernier caliper and reporting in cm.

2.4 Dry matter plant^{-1} (g)
For determining the dry matter, five plants were randomly removed periodically at 28, 56, 84 DAT and harvest. The roots of these plants were separated, plants and bulbs were cut into small pieces, dried first in open air and later in thermostatically controlled oven at 65±5 °C till the constant weight were obtained. The dry matter was taken at 30 days interval, starting from 28 DAT up to the harvest. It was expressed in g plant^{-1}.

3. Results and Discussion
3.1 Plant height (cm)
The data pertaining to the mean plant height of *kharif* onion as influenced periodical by different treatment is presented in Table 1. The mean plant height at 28, 56, 84 days after transplanting and at harvest were 30.19, 44.12, 53.24 and 50.65 cm, respectively.

The mean plant height increased progressively with the advancement up to 84 DAT in the age of the plant. The plant growth rate in terms of plant height was more vigorous during the period of 28 to 84 days after transplanting and it was decreased slowly till harvest. At 28 DAT plant height gives non-significant response to different weed management treatments. Plant height ranging from 32.80 to 33.80 cm.

The plant height was influenced significantly due to different weed control treatments. Treatment T_9 exhibited significantly highest plant height at 56, 84 and at harvest than the rest of the treatments. However, it was at par with treatment T_6, T_7 and T_8. This might due to higher accumulation of photosynthesis in leaves, stem and less crop weed competition. Treatment T_{10} recorded lowest plant height at 56, 84 and at harvest. These findings are in accordance with those reported by Patel *et al*. (2012) [6] and Sable *et al*. (2013) [7].

3.2 Number of leaves plant^{-1}
Data regarding mean number of leaves plant^{-1} of *kharif* onion as influenced by different weed control treatments are presented in Table 1. The mean number of leaves plant^{-1} was 3.60, 8.56, 9.55 and 9.58 at 26, 56, 84 days after transplanting and at harvest, respectively. The mean number of leaves plant^{-1} was found to be increased progressively up to 84 DAT in crop age. Maximum number of leaves plant^{-1} was recorded at 84 DAT. At 28 DAT number of leaves plant^{-1} gives non-significant response to different weed management treatments. The difference in mean number of leaves plant^{-1} was influenced significantly at 56, 84 and at harvest stages of observations due to different weed control treatments.

The mean number of leaves plant^{-1} under treatment T_9 was significantly higher than rest of treatments. However, at 56 DAT and at harvest it was at par with treatment T_6, T_7 and $_{T8.}$ At 84 DAT it was at par with treatment T_8.

The lowest number of leaves plant^{-1} were recorded from treatment T_{10}. This might be attributed to more competition for light, nutrients and space in the weedy check. Due to less crop weed competition in weed free check, application of post emergence and ready mix post emergence herbicide might have resulted in broad spectrum weed control during crop weed competition period and there by less competition for light, nutrient, moisture and space in the weed free environment. These results are in conformity with those reported by Kalhapure and Shete (2013) [4].

3.3 Neck thickness (cm)
Data regarding mean neck thickness of onion of *kharif* onion as influenced by different weed control treatments are presented in Table 2. The difference in mean neck thickness of onion was influenced significantly at all the stages of observations due to different weed control treatments.

AT 56 DAT the mean neck thickness of onion under treatment T9 was significantly desirable than rest of treatments. At 84 DAT and at harvest, it was at par with treatment T_4, T_6, T_7 and T_8.

The lowest neck thickness of onion recorded from treatment T10. This might due attribute to more competition for light, nutrients and space in weed check environment. These results are in conformity with those reported by Yumnam *et al.* (2009) [12].

3.4 Dry matter plant^{-1} (g)
The data pertaining to average dry matter plant^{-1} of *kharif* onion as influenced periodical by different treatments are presented in Table 2. The mean dry matter plant^{-1} was 4.10, 6.93, 10.64 and 17.89 g at 28, 56, 84, DAT and at harvest, respectively.

The average dry matter plant^{-1} was influenced significantly due to different weed control treatments. The mean dry matter plant^{-1} under weed free check treatment was significantly higher than rest of the treatments. However, at 28 DAT, 84 and at harvest it was at par with treatment T_8. At 56 DAT it was at par with T_4, T_6, T_7 and T_8.

This might be due to higher accumulation of photosynthesis in leaves, stem and reproduction parts due to less crop weed competition.

Less crop weed competition in herbicide treatment attributed to broad spectrum weed control during critical crop weed competition period due to application of post emergence and hand weeding also resulted reducing the weed density and

weed dry matter and there with less crop weed competition. Similar results were recorded by Chopra and Chopra (2007) [2], Shinde *et al*. (2012) [11] and Barla *et al*. (2019) [1].

Table 1: Effect of different weed management practices on plant height and number of leaves plant-1 of kharif onion at 28, 56, 84 and at harvest

Treatment	Plant height (cm)				Number of leaves plant^{-1}			
	28 DAT	56 DAT	84 DAT	At harvest	28 DAT	56 DAT	84 DAT	At harvest
T_1: Oxyflourfen 23.5% EC (PE) @100 g a.i/ha.	33.49	46.87	55.87	54.00	3.40	8.80	9.47	8.5
T_2: Pendimethalin 38.7% CS (PE) @ 677.25 g a.i/ha.	33.07	47.07	56.87	55.53	3.53	9.07	9.80	9.4
T_3: Oxyflourfen 23.5% EC (PE) @ 100 g a.i/ha. fb Hand weeding 40 DAT.	33.80	48.43	57.63	56.40	3.60	9.33	10.00	9.6
T_4: Pendimethalin 38.7% CS (PE) @ 677.25 g a.i/ha. fb Hand weeding 40 DAT.	33.07	51.17	62.17	57.57	3.80	9.73	10.87	10.5
T_5: Oxyflourfen 23.5% EC (PE) @100 g a.i/ha. fb Quizalofop ethyl (PoE) 5% EC @ 37.5 g a.i/ha at 30 DAT.	32.80	48.87	59.80	56.87	3.73	9.40	10.60	10.1
T_6: Pendimethalin 38.7% CS (PE) @ 677.25 g a.i/ha. fb Quizalofop ethyl (PoE) 5% EC @37.5 g a.i/ha at 30 DAT.	34	52.63	63.17	59.87	4.67	10.20	11.40	11
T_7: Oxyflourfen 23.5% EC (PE) @100 g a.i/ha. fb Ready mix Propaquizafop 5% EC + Oxyflourfen 12% EC (43.75+105) g a.i/ha at 30 DAT.	33.21	50.93	62.67	58.73	4.07	10.07	11.00	10.5
T_8: Pendimethalin 38.7% CS (PE) @ 677.25 g a.i/ha. fb Ready mix Propaquizafop 5% EC + Oxyflourfen 12% EC (43.75+105) g a.i/ha at 30 DAT.	34.57	53.00	64.10	60.60	4.93	10.47	11.53	11
T_9: Weed free check (2 Hand weeding at 20 and 40 DAT)	33.67	54.85	64.80	62.13	5.00	10.73	11.93	11.2
T_{10}: Unweeded check (Control)	33.80	34.27	41.27	38.80	2.73	6.67	8.40	8.1
S. Em ±	1.00	1.79	1.63	1.53	0.11	0.26	0.29	0.29
C. D. at 5%	NS	5.34	4.86	4.57	NS	0.77	0.86	0.86
General Mean	30.19	44.12	53.24	50.65	3.60	8.56	9.55	9.58
C V	5.75	7.06	5.33	5.26	5.35	5.26	5.28	5.27

Table 2: Effect of different weed management practices neck thickness and dry matter of plant^{-1} *kharif* onion at 28, 56, 84 and at harvest

Treatment	Neck Thickness (cm)			Dry matter of plant^{-1} (g)			
	56 DAT	84 DAT	At harvest	28 DAT	56 DAT	84 DAT	At harvest
T_1: Oxyflourfen 23.5% EC (PE) @ 100 g a.i/ha.	0.72	1.19	0.95	3.77	6.65	10.58	18.62
T_2: Pendimethalin 38.7% CS (PE) @ 677.25 g a.i/ha.	0.77	1.27	1.18	4.22	7.26	11.15	19.55
T_3: Oxyflourfen 23.5% EC (PE) @ 100 g a.i/ha. fb Hand weeding 40 DAT.	0.81	1.32	1.22	4.37	7.47	11.53	19.86
T_4: Pendimethalin 38.7% CS (PE) @ 677.25 g a.i/ha. fb Hand weeding 40 DAT.	0.86	1.45	1.32	4.95	8.22	12.10	20.66
T_5: Oxyflourfen 23.5% EC (PE) @100 g a.i/ha. fb Quizalofop ethyl (PoE) 5% EC @ 37.5 g a.i/ha at 30 DAT.	0.84	1.36	1.27	4.47	7.57	11.59	20.59
T_6: Pendimethalin 38.7% CS (PE) @ 677.25 g a.i/ha. fb Quizalofop ethyl (PoE) 5% EC @37.5 g a.i/ha at 30 DAT.	0.97	1.51	1.36	5.45	8.66	12.90	22.14
T_7: Oxyflourfen 23.5% EC (PE) @100 g a.i/ha. fb Ready mix Propaquizafop 5% EC + Oxyflourfen 12% EC (43.75+105) g a.i/ha at 30 DAT.	0.94	1.50	1.34	5.28	8.51	12.41	21.40
T_8: Pendimethalin 38.7% CS (PE) @ 677.25 g a.i/ha. fb Ready mix Propaquizafop 5% EC + Oxyflourfen 12% EC (43.75+105) g a.i/ha at 30 DAT.	0.98	1.54	1.38	5.63	8.79	13.71	22.83
T_9: Weed free check (2 Hand weeding at 20 and 40 DAT)	1.03	1.58	1.41	5.87	8.91	14.22	23.68
T_{10}: Unweeded check (Control)	0.50	0.78	0.73	0.84	3.96	6.82	8.24
S. Em ±	0.02	0.04	0.03	0.12	0.27	0.32	0.56
C. D. at 5%	0.07	0.12	0.10	0.37	0.80	0.97	1.66
General Mean	0.79	0.97	0.88	4.10	6.93	10.64	17.89
C V	5.26	7.45	6.98	5.29	6.75	5.33	5.44

4. Conclusion

It is concluded that treatment T_9 is significantly superior among all the treatments in growth attributing characters. Amid different herbicidal treatments T_8 documented significantly highest plant height, number of leaves, neck thickness and dry matter plant-1 while T_{10} recorded lowest values. For effective weed control Pendimethalin 38.7% CS (PE) @ 677.25 g a.i/ha. fb Ready mix Propaquizafop 5% EC + Oxyflourfen 12%EC (43.75+105) g a.i/ha at 30 DAT is the best options under labour scarcity conditions.

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