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HERBICIDE–MULCH INTERACTIONS IN ONION: IMPLICATIONS FOR WEED SUPPRESSION, NUTRIENT DYNAMICS AND BULB YIELD

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ABSTRACT

A field experiment was conducted during the *Rabi* season at College Farm, College of Agriculture, Rajendranagar, PJTAU, to assess the influence of integrated weed management practices on nutrient uptake by onion (*Allium cepa* L.) and nutrient removal by weeds. The experiment was laid out in a randomized block design with eleven treatments with three replications. Among the treatments, pendimethalin 38.7% CS at 677.25 g ha^{-1} (PE) + polyfilm mulch and oxyfluorfen 23.5% EC at 100 g ha^{-1} (PE) + polyfilm mulch recorded lower weed density, weed dry matter and higher bulb yield and nutrient uptake by the crop and were statistically comparable to mechanical weeding at 20 and 40 DAT. The lowest nutrient removal by weeds was observed with mechanical weeding twice at 20 and 40 DAT, followed closely by pendimethalin + mulch and oxyfluorfen + mulch, whereas the unweeded check recorded the highest nutrient depletion compared to all other weed management practices. Overall, integrated weed management practices involving herbicides combined with mulch or timely mechanical weeding proved effective in improving nutrient uptake and productivity of onion.

***Key words*:** Integrated weed management, Yield. Polyfilm mulch, Mechanical weeding, Weed density, Nutrient uptake and Nutrient removal

Introduction

Onion (*Allium cepa* L.) is a major vegetable crop of global economic importance, ranking second after tomato in terms of income generation. It belongs to the family *Alliaceae* and is rich in sulphur-containing compounds such as allicin and allyl propyl disulfide, which impart its characteristic pungency and aroma (Griffiths *et al*., 2002; Meher *et al*., 2016;). Owing to its distinctive flavor and culinary value, onion is popularly referred to as the “Queen of the kitchen.” Furthermore, regular consumption of onion has been associated with beneficial effect on cardiovascular health due to its antioxidant and antithrombotic properties (Sangha and Baring, 2003).

Globally, India ranks first in area under onion cultivation and second in production after China, yet its productivity remains relatively low compared to other major producing countries (FAOSTAT, 2023). Among the constraints associated in onion production, weed infestation is one of the most critical. As onion is a weak competitor due to its slow initial growth, narrow and sparse foliage, shallow root system and short plant stature (Tripathi *et al*., 2020). Weeds compete intensely with onion for nutrients, moisture, light and space, leading to yield losses ranges from 40–80%, depending on weed intensity and species composition (Ramalingam *et al*., 2013; Singh and Singh, 2021). Single weed management practice is often insufficient to maintain weed free situation during critical period of crop weed competition. Hence, the present study was undertaken to evaluate the effectiveness of integrated weed management (IWM) practices on nutrient uptake and nutrient removal by weeds in onion.

Material and Methods

The field investigation was carried out during the *Rabi* season of 2021–22 at College Farm, College of Agriculture, Rajendranagar, Professor Jayashankar Telangana Agricultural University (PJTAU), Hyderabad. The experimental site is situated in the Southern Agro-Climatic Zone of Telangana and falls under semi-arid tropical climate. The soil of the experimental field was classified as sandy loam in texture, having a neutral soil reaction (pH 7.1), medium organic carbon content (0.71%), low available nitrogen (233.7 kg ha^{-1}), high available phosphorus (32.71 kg ha^{-1}), and medium potassium (334.24 kg ha^{-1}), as determined by standard soil analytical procedures prior to planting. The experimental layout consisted of eleven weed management practices laid out in a randomized block design with three replications. The treatment details were T_1- Oxyfluorfen 23.5% EC @ 100 g ha^{-1} (PE) + mechanical weeding at 30 DAT; T_2-Oxyfluorfen 23.5% EC @ 100 g ha^{-1} (PE) + polyfilm mulch;T_3-Pendimethalin 38.7% CS @ 677.25 g ha^{-1} (PE) + mechanical weeding at 30 DAT; T_4-Pendimethalin 38.7% CS @ 677.25 g ha^{-1} (PE) + polyfilm mulch; T_5- Stale seedbed followed by Propaquizafop 5% + Oxyfluorfen 12% EC @ 148 g ha^{-1} (PoE); T_6- Stale seedbed followed by Quizalofop-ethyl 4% + Oxyfluorfen 6% EC @ 100 g ha^{-1} (PoE); T_7-Pendimethalin 38.7% CS @ 677.25 g ha^{-1} (PE) followed by Propaquizafop 5% + Oxyfluorfen 12% EC @ 148 g ha^{-1} (PoE);T_8- Pendimethalin 38.7% CS @ 677.25 g ha^{-1} (PE) followed by Quizalofop-ethyl 4% + Oxyfluorfen 6% EC @ 100 g ha^{-1} (PoE); T_9- Pendimethalin 38.7% CS @ 677.25 g ha^{-1} (PE) + intercropping with fenugreek; T_{10}-Mechanical weeding at 20 and 40 DAT; T_{11}-Weedy check (control). The onion variety 'Bhima Super' (red bulb type) was transplanted on 10 November 2021 at a spacing of 30 × 10 cm. Simultaneously, fenugreek variety 'Pusa Early Bunch' was sown in the designated intercropping plots. A recommended fertilizer dose of 110:40:60 kg N:P_2O_5 : K_2O ha^{-1} was applied through urea, single superphosphate and muriate of potash respectively. Entire phopshrous and potassium was applied as basal to the crop. Nitrogen was applied in split doses at basal, 30 DAT and 45 DAT to ensure sustained availability. In stale seedbed treatment, light irrigation was provided to induce weed germination, followed by manual removal of emerged weeds before transplanting the onion seedlings. Polyfilm mulch (black polyethylene sheet of 30 µm thickness) was installed between crop rows one week after transplanting. Pre-emergence herbicides were sprayed within 24 hours of transplanting, whereas post-emergence herbicides were applied at 2–3 leaf stage using a knapsack sprayer calibrated to deliver 500 litres of spray solution per hectare. For biometric observations, five representative plants were randomly selected and tagged from each treatment plot and the recorded data was averaged. Weed density and weed dry matter production data were subjected to square root transformation ($\sqrt{x+1}$) to normalize variance before statistical analysis. The nitrogen content (%) was estimated by modified Micro Kjeldahl method by using Kel-plus instrument, after digesting the powdered plant and weed samples with diacid mixture using H_2SO_4 and H_2O_2 (Piper, 1966). Phosphorus content was determined after digesting the crop and weed samples separately with triacid mixture of 9:4:1 of HNO_3: H_2SO_4: $HClO_4$ (Piper, 1966). The phosphorus concentration in the plant digest was determined by Vanado-Molybdo phosphoric yellow colour method. The intensity of the yellow colour was measured with spectrophotometer at 420 nm and the concentration was expressed in percent. The potassium content in the triacid digested mixture was determined by using Flame Photometer (Piper, 1966).

$$\text{Nutrient uptake (kg ha}^{-1}) = \frac{\text{Total dry weight (kg ha}^{-1})\times\text{Nutrient content (\%)}}{100}$$

Pendimethalin 38.7% CS 677.25 g ha^{-1} PE + polyfilm mulch at 20 DAT

Oxyfluorfen 23.5% EC 100 g ha^{-1} PE + polyfilm mulch at 40 DAT

Mechanical weeding at 40 DAT

Plate 1: Field view of the experiment.

Table 1: Effect of integrated weed management practices on weed density, weed dry matter and weed control efficiency at 40 DAT.

Treatments	TWD	TWDM	WCE
T_1	5.15(25.49)	3.43(10.73)	64.37
T_2	3.09(8.55)	2.17(3.71)	87.67
T_3	4.95(23.51)	3.36(10.31)	65.77
T_4	2.96(7.76)	2.11(3.44)	88.59
T_5	5.74(31.93)	3.88(14.05)	53.36
T_6	5.91(33.89)	3.99(14.91)	50.49
T_7	4.43(18.58)	3.03(8.17)	72.87
T_8	4.61(20.21)	3.06(8.35)	72.29
T_9	5.98 (34.75)	4.04(15.28)	49.26
T_{10}	2.86 (7.19)	2.04(3.16)	89.50
T_{11}	8.34 (68.48)	5.58 (30.12)	-
SEm±	0.28	0.13	
LSD (p=0.05)	0.83	0.41	-

TWD: Total Weed density(No.m^{-2}); TWDM: Total Weed dry matter (g m^{-2}); WCE: Weed control efficiency (%)

Note: Figures in parenthesis () are the original values; square root transformation (√x+1) used for statistical analysis.

T_1 - Oxyfluorfen 23.5% EC 100 g ha^{-1} PE + mechanical weeding at 30 DAT, **T_2** - Oxyfluorfen 23.5% EC 100 g ha^{-1} PE + polyfilm mulch, **T_3** - Pendimethalin 38.7% CS 677.25 g ha^{-1} PE + mechanical weeding at 30 DAT, **T_4** - Pendimethalin 38.7% CS 677.25 g ha^{-1} PE + polyfilm mulch, **T_5** - Stale seed bed *fb* propaquizafop 5% + oxyfluorfen 12% EC 148 g ha^{-1} PoE, **T_6** - Stale seed bed *fb* quizalofop ethyl 4%+ oxyfluorfen 6% EC 100 g ha^{-1} PoE, **T_7** - Pendimethalin 38.7% CS 677.25 g ha^{-1} PE *fb* propaquizafop 5%+ oxyfluorfen 12 % EC 148 g ha^{-1} PoE, **T_8** - Pendimethalin 38.7% CS 677.25 g ha^{-1} PE *fb* quizalofop ethyl 4% + oxyfluorfen 6% EC 100 g ha^{-1} PoE, **T_9** - Pendimethalin 38.7% CS 677.25 g ha^{-1} PE and intercrop with fenugreek, **T_{10}** - Mechanical weeding at 20, 40 DAT, **T_{11}** - Weedy check

Results and Discussion

Total weed density (No. m^{-2})

The predominant weed flora recorded in the experimental field was *Parthenium hysterophorus*, *Trianthema portulacastrum*, *Amaranthus viridis*, *Convolvulus arvensis*, *Celosia argentea* and *Digera arvensis* among the broad-leaved weeds, while *Cynodon dactylon*, *Eleusine indica* and *Panicum repens* were the dominant grassy weeds. Among sedges, *Cyperus rotundus* was observed as the most persistent and aggressive species throughout the entire crop growth period. Similar weed flora composition in onion fields during *Rabi* season has been reported by Priyadarshini and Anburani (2004), In the present onion experiment, no phytotoxic symptoms such as leaf chlorosis, necrosis and growth retardation were observed in treatments involving pre and post emergence herbicides.

Significantly lower weed density and weed dry matter were recorded in the treatments pendimethalin (PE) + polyfilm mulch and oxyfluorfen (PE) + polyfilm mulch, which were statistically comparable with mechanical weeding at 20 and 40 DAT. These treatments followed by pendimethalin (PE) *fb* propaquizafop + oxyfluorfen (PoE), pendimethalin (PE) *fb* quizalofop ethyl + oxyfluorfen PoE, pendimethalin (PE) + mechanical

Table 2. Effect of integrated weed management practices on yield and nutrient uptake of onion.

Treatments	Bulb yield (kg ha^{-1})	Nutrient uptake (kg ha^{-1})		
		N	P	K
T_1	12510	43.89	9.52	50.76
T_2	17328	56.14	14.85	58.17
T_3	12585	45.73	10.62	51.42
T_4	17635	58.97	15.52	62.47
T_5	9183	35.60	7.71	43.48
T_6	9091	33.45	6.53	40.09
T_7	14859	48.42	12.91	52.00
T_8	14639	46.10	11.85	51.95
T_9	7666	26.46	6.35	39.13
T_{10}	18328	59.67	16.03	63.37
T_{11}	2172	20.00	2.59	22.73
SEm±	798	2.16	0.53	1.96
LSD (p=0.05)	2353	6.38	1.55	5.77

N: Nitrogen; P: Phosphorus; P: Potassium

T_1 - Oxyfluorfen 23.5% EC 100 g ha^{-1} PE + mechanical weeding at 30 DAT, **T_2** - Oxyfluorfen 23.5% EC 100 g ha^{-1} PE + polyfilm mulch, **T_3** - Pendimethalin 38.7% CS 677.25 g ha^{-1} PE + mechanical weeding at 30 DAT, **T_4** - Pendimethalin 38.7% CS 677.25 g ha^{-1} PE + polyfilm mulch, **T_5** - Stale seed bed *fb* propaquizafop 5% + oxyfluorfen 12% EC 148 g ha^{-1} PoE, **T_6** - Stale seed bed *fb* quizalofop ethyl 4%+ oxyfluorfen 6% EC 100 g ha^{-1} PoE, **T_7** - Pendimethalin 38.7% CS 677.25 g ha^{-1} PE *fb* propaquizafop 5%+ oxyfluorfen 12 % EC 148 g ha^{-1} PoE, **T_8** - Pendimethalin 38.7% CS 677.25 g ha^{-1} PE *fb* quizalofop ethyl 4% + oxyfluorfen 6% EC 100 g ha^{-1} PoE, **T_9** - Pendimethalin 38.7% CS 677.25 g ha^{-1} PE and intercrop with fenugreek, **T_{10}** - Mechanical weeding at 20, 40 DAT, **T_{11}** - Weedy check

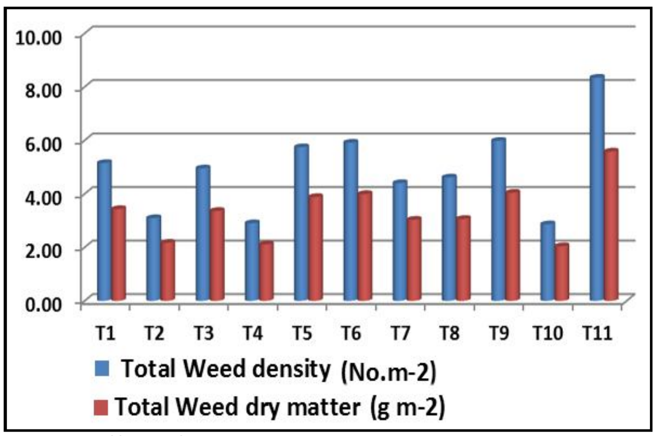

Fig. 1: Effect of integrated weed management practices on weed density and weed dry matter at 40 DAT.

Table 3: Effect of integrated weed management practices on nutrient removal by weeds at 40 DAT.

Treatments	Nutrient uptake (kg ha^{-1})		
	Nitrogen	Phosphorus	Potassium
T_1	2.76	1.78	2.17
T_2	1.95	1.27	1.35
T_3	2.64	1.76	2.11
T_4	1.82	1.13	1.22
T_5	3.19	2.08	2.60
T_6	3.41	2.14	2.63
T_7	2.39	1.67	1.79
T_8	2.42	1.72	1.93
T_9	3.58	2.48	2.71
T_{10}	1.73	0.93	1.13
T_{11}	4.32	3.09	3.49
SEm±	0.15	0.13	0.13
LSD (p=0.05)	0.42	0.40	0.30

$\mathbf{T_1}$ - Oxyfluorfen 23.5% EC 100 g ha^{-1} PE + mechanical weeding at 30 DAT, $\mathbf{T_2}$ - Oxyfluorfen 23.5% EC 100 g ha^{-1} PE + polyfilm mulch, $\mathbf{T_3}$ - Pendimethalin 38.7% CS 677.25 g ha^{-1} PE + mechanical weeding at 30 DAT, $\mathbf{T_4}$ - Pendimethalin 38.7% CS 677.25 g ha^{-1} PE + polyfilm mulch, $\mathbf{T_5}$ - Stale seed bed *fb* propaquizafop 5% + oxyfluorfen 12% EC 148 g ha^{-1} PoE, $\mathbf{T_6}$ - Stale seed bed *fb* quizalofop ethyl 4%+ oxyfluorfen 6% EC 100 g ha^{-1} PoE, $\mathbf{T_7}$ - Pendimethalin 38.7% CS 677.25 g ha^{-1} PE *fb* propaquizafop 5%+ oxyfluorfen 12 % EC 148 g ha^{-1} PoE, $\mathbf{T_8}$ - Pendimethalin 38.7% CS 677.25 g ha^{-1} PE *fb* quizalofop ethyl 4% + oxyfluorfen 6% EC 100 g ha^{-1} PoE, $\mathbf{T_9}$ - Pendimethalin 38.7% CS 677.25 g ha^{-1} PE and intercrop with fenugreek, $\mathbf{T_{10}}$ - Mechanical weeding at 20, 40 DAT, $\mathbf{T_{11}}$ - Weedy check

weeding at 30 DAT and oxyfluorfen (PE) + mechanical weeding at 30 DAT which were comparable with each other. The superior weed suppression observed in pre emergence herbicide + mulch treatments may be attributed to the herbicidal action combined with physical obstruction by mulch, which effectively restricted weed seed germination and early seedling emergence during the critical period of weed competition. As a result, weeds failed to establish. These findings are in line with Sharma and Kumar (2020).

Weed Dry Matter (g m^{-2})

Mechanical weeding at 20 and 40 DAT exhibited the lowest weed dry matter accumulation. This treatment was statistically comparable to pre-emergence application of pendimethalin or oxyfluorfen in combination with polyfilm mulch. These were followed by pendimethalin applied as pre-emergence followed by propaquizafop + oxyfluorfen as post-emergence and pendimethalin as pre-emergence followed by quizalofop-ethyl + oxyfluorfen as post-emergence, which also resulted in comparatively lower weed dry matter. The sequential weed management practices may be cultural or chemical ensured proper control by suppressing both early-emerging and later flushes of weeds during the critical competition period which resulted in reduced weed biomass. The results are in agreement with the findings of Chauhan and Abugho, (2012) and Kalhapure *et al.*, (2013). In contrast, the unweeded control consistently recorded the highest weed dry matter throughout the crop growth stages due to uninterrupted weed proliferation and their competitive advantage over the crop.

Weed control efficiency (%)

Among the weed management practices, mechanical weeding at 20 and 40 DAT registered higher weed control efficiency. This was closely followed by pendimethalin along with polyfilm mulch and oxyfluorfen used with polyfilm mulch. The superior performance of these integrated weed management approaches can be attributed to their ability to suppress weed emergence and subsequent biomass accumulation thereby resulting in significantly higher weed control efficiency compared to the weedy check. These findings corroborate the observations of Sahoo *et al.*, (2017) and Urraiya and Jha (2018).

Effect on bulb yield (kg ha^{-1})

The application of pendimethalin as a pre-emergence (PE) herbicide in conjunction with polyfilm mulch, as well as oxyfluorfen as PE combined with polyfilm mulch, resulted in the highest bulb yield of onion. These treatments were found to be statistically comparable to the mechanical weeding at 20 and 40 days after transplanting (DAT). The superior performance of pendimethalin and oxyfluorfen in mulched plots may be due to effective weed suppression. Pendimethalin inhibits formation of microtubules, which prevent root and shoot development in germinating weed seeds, while oxyfluorfen acts through protoporphyrinogen oxidase (PPO) inhibition, leading to rapid cell membrane oxidation in susceptible weed seedlings (Zimdahl, 2018). The addition of black polyethylene mulch further restricted weed emergence

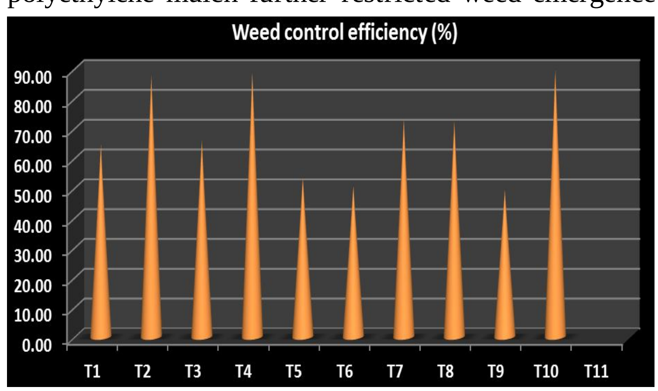

Fig. 2: Effect of integrated weed management practices on weed control efficiency at 40 DAT.

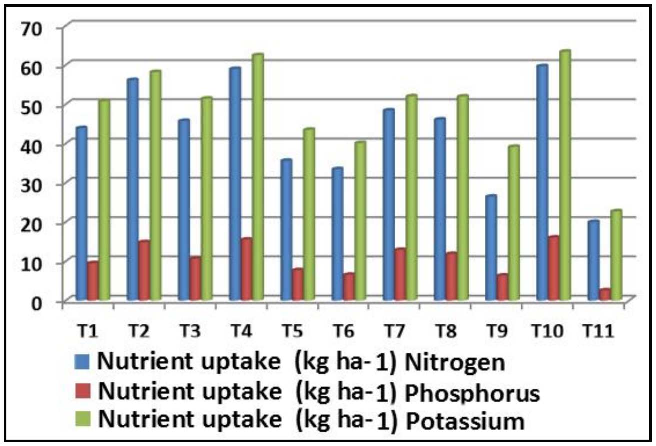

Fig. 3: Effect of integrated weed management practices on nutrient uptake of onion.

by blocking photosynthetically active radiation (PAR) required for weed seed germination, thereby extending the weed suppression period beyond the residual activity window of the herbicides (Kasirajan and Ngouajio, 2012).

The weed-free micro-environment facilitated by these treatments ensured minimal competition for moisture, nutrients and light enabled onion to utilize available soil nutrients more efficiently and intercept greater solar radiation and enhance in net photosynthetic rate. This directly contributed to enhanced dry matter accumulation and more efficient assimilate partitioning towards bulb formation, resulting in larger bulb size and higher yield Similar reports by Ghosh and Sharma, (2019) and Shravani *et al*., (2024)

Effect on nutrient uptake by crop (kg ha^{-1})

Higher uptake of nitrogen, phosphorus and potassium were recorded with pendimethalin as pre-emergence (PE) along with polyfilm mulch treatment, which remained statistically at par with oxyfluorfen as pre emergence+ polyfilm mulch and mechanical weeding at 20 and 40 DAT. The improved nutrient uptake in these treatments can be attributed effective control of broad spectrum of weeds, which significantly reduced competition for essential growth resources such as nutrients, moisture,

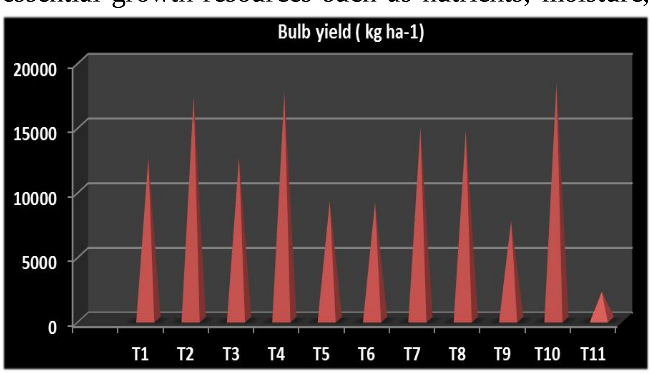

Fig. 4: Effect of integrated weed management practices on yield of onion.

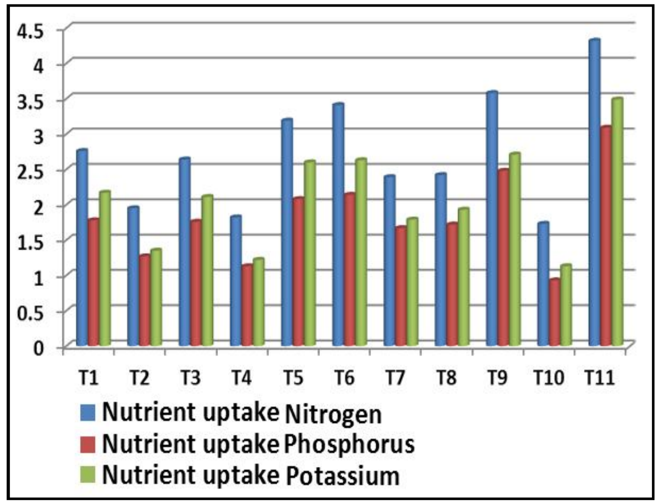

Fig. 5: Effect of integrated weed management practices on nutrient removal by weeds at 40 DAT.

space and light. This environment enabled onion plants to maintain high photosynthetic activity and allocate greater assimilates for bulb growth and dry matter accumulation, leading to improved nutrient assimilation and translocation. The results are in accordance with the findings of Jadhav *et al*., (2021) and Deshpande *et al*., (2022).

Effect on nutrient removal by weeds (kg ha^{-1})

The unweeded control recorded the highest nutrient depletion, which was attributed to greater weed density and higher competitive ability of dominant weed flora for available soil nutrients (Sharma *et al*., 2018). In contrast, the lowest nutrient loss was observed in the plots subjected to mechanical weeding at 20 and 40 DAT which was statistically comparable with pendimethalin (PE) + polyfilm mulch and oxyfluorfen (PE) + polyfilm mulch. The integration of pre-emergence herbicides with mulching effectively suppressed early weed germination and maintained a weed-free environment, thereby reducing weed-crop competition for nutrients and moisture and improve the availability of nutrients to the crop which minimize the nutrient loss through weeds, which aligns with the findings of Reddy *et al*., (2019) and Shwetha *et al*., (2020).

Conclusion

From this study it was observed that, a mong the weed management practices evaluated, pendimethalin or oxyfluorfen as pre-emergence in combination with polyfilm mulch was most effective in reducing weed density, conserving soil moisture and enhancing nutrient uptake and bulb yield. Therefore, integrating herbicides with mulching is an efficient and sustainable weed management strategy for improving nutrient uptake and maximizing onion yield.

References

Chauhan, G.S. and Abugho S.B. (2012). Efficacy of herbicides on weed control and productivity of onion. *Journal of Plant Protection Research*, **52(4)**, 458–463.

Deshpande, S.K., Thorat S.T. and Karande A.A. (2022). Integrated weed management in rabi onion. *International Journal of Chemical Studies*, **10(1)**, 45–50.

Ghosh, S. and Sharma D. (2019). Physiological determinants of bulb yield in onion. *Journal of Horticultural Research*, **27(2)**, 45–52.

Griffiths, G., Trueman L., Crowther T., Thomas B. and Smith B. (2002). Onions—A global benefit to health. *Phytother Res*. **16(7)**, 603–615.

Jadhav, S.S., Khodke U.M. and Kale R.B. (2021). Effect of herbicides and mulches on weed dynamics and growth of onion. *Journal of Pharmacognosy and Phytochemistry*, **10(1)**, 302–307.

Kalhapure, A.H., Shete B.T. and Bodake P.S. (2013). Effect of integrated weed management on growth and yield of onion. *Indian Journal of Weed Science*. **45(3)**, 224–226.

Kasirajan, S. and Ngouajio M. (2012). Polyethylene and biodegradable mulches for agricultural applications. *Journal of Applied Polymer Science*, **131**, 397–425.

Meher, R., Mandal J., Saha D. and Mohanta S. (2016). Effect of sulphur application in onion (*Allium cepa* L.), *Journal of Crop and Weed*. **12(3)**, 86-90.

Piper, C.S. (1966). Soil and Plant Analysis. Hans publishers. 368.

Priyadarshini, K. and Anburani A. (2004). Effect of weed management practices on weed growth and yield of onion. *Indian Journal of Weed Science*. **36(1–2)**, 65–67.

Ramalingam, S.P., Chinnagouder C., Perumal M. and Palaniswamy M.A. (2013). Evaluation of new formulation of oxyfluorfen (23.5% EC) for weed control efficiency and bulb yield in onion. *Indian Journal of Agronomy*. **15(2)**, 13-17.

Reddy, M.V., Umajyothi K., Reddy P.S.S. and Sasikala K. (2019). Effect of pre and post emergence herbicides on nutrient removal and uptake in onion Cv. N-53. *International Journal of Current Science*. **7(5)**, 1809-1812.

Sahoo, S.C., Mishra M.K. and Sahu G. (2017). Efficacy of herbicides and their effect on bulb yield of onion. *International Journal of Current Microbiology and Applied Sciences*, **6(7)**, 1232–1240.

Sangha, J.K. and Baring P. (2003). Efficacy of multiple dietary therapies in reducing risk factors for coronary heart disease. *Journal of Human Ecology*. **14(1)**, 33-36.

Sharma, D. and Kumar R. (2020). Nutrient dynamics and bulb development in onion. *Journal of Horticultural Research*, **28(2)**, 59–67.

Sharma, R., Singh R.K. and Pandey V. (2018). Herbicide efficacy and crop safety in onion under different weed management practices. *Journal of AgriSearch*, **5(2)**, 120–125.

Shravani, Ch., Parameswari Y.S., Madhavi M. and Ram Prakash T. (2024). Effect of integrated weed management practices on weed parameters and yield of onion (*Allium cepa* L.). *International Journal of Research in Agronomy*. **7(10)**, 375-377.

Shwetha, B., Ramesha Y.M. and Rajeshwari K. (2020). Influence of weed management practices on growth and yield of onion. *International Journal of Chemical Studies*. **8(5)**, 2042–2045.

Singh, M. and Singh V.P. (2021). Impact of integrated weed management on productivity and nutrient uptake in onion. *Journal of Environment and Biology*. **42(4)**, 920–926.

Tripathi, N., Verma S.K. and Dixit A. (2020). Weed management approaches in onion: A review. *International Journal of Chemical Studies*. **8(2)**, 1234–1240.

Urraiya, S. and Jha A.K. (2018). Integrated weed management in onion for higher yield and economic returns. *Journal of Pharmacognosy and Phytochemistry*, **7(3)**, 1678–1682.

Zimdahl, R.L. (2018). *Fundamentals of Weed Science*. Academic Press.