The Pharma Innovation Journal 2023; 12(12): 488-493

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(12): 488-493

www.thepharmajournal.com
Received: 24-10-2023
Accepted: 27-11-2023

Dheerendra Singh
Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Avinash Sharma
Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Jaideep Singh Bhadauriya
Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Devendra
Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Nishita Kushwah
Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Shailendra Singh Kushwah
Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Corresponding Author:
Dheerendra Singh
Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Effect of various weed control measures on population of different weed species at successive crop growth stages in potato (*Solanum tuberosum* L.)

Dheerendra Singh, Avinash Sharma, Jaideep Singh Bhadauriya, Devendra, Nishita Kushwah and Shailendra Singh Kushwah

Abstract
An investigation conducted on "Effect of weed management practices on weeds, growth and yield of potato (*Solanum tuberosum* L.) under organic farming ". The field experiment was conducted at the Directorate of weed science Research (DWSR) Centre, College of Agriculture, (RVSKVV) Gwalior (M.P.) during the *rabi* season of 2016-2017.The experiment was laid out in randomized block design with 10 treatments replicated three times. The data pertaining to weed count recorded at 25, 40 DAP and harvest stage were subjected to square root transformation $\sqrt{X+0.5}$,$\sqrt{X}$, Log x, and Log x+1 for statistical analysis. The dominant weeds flora observed in the experimental field were *Chenopodium album, Anagallis arvensis, Spergula arvensis and Medicago hispida*. Among treatments of organic weed control, Treatment T_6 (Two hand weeding at 20 and 40 DAP) observed most effective in controlling both broad and narrow leaf weeds, as well as total dry weight (g/m^2) and these were significantly reduced weed population.

Keywords: Weed flora, control methods, organic control and potato etc.

Introduction
Potato (*Solanum tuberosum* L.) is a herbaceous annual that grow up to 100cm and contributes substantially towards food and nutritional security in the world. The potato is a crop with a large number of wild relatives, a group of more than 100 tuber bearing *Solanum* species. It originated in the high Andean hills of South America. Potato is believed to have been introduced in India from Europe in early 17th century AD. The potato is ranked by FAO of United Nations as the world's 4th most important food plant behind rice, wheat and maize (FAO, 2006).

It is used for variety of purposes and typically used as a vegetable as a result regarded as "King of vegetable". But in fact, it is likely that less than 50 per cent of potato grown worldwide is consumed fresh in the form of vegetable. The rest are processed into potato food product (potato flour, chips, French fries etc.) and food ingredients, food to cattle, pigs and chickens and processed into starch for industry.

In India potato production is mainly confined to Uttar Pradesh, West Bengal, Madhya Pradesh, Punjab, Assam, Gujarat and Haryana. In India, it is grown on an area of 2 million hectares with the production of 44.3 million tonnes and the productivity is 21967 kg/ha (Anonymous, 2015). Currently, Madhya Pradesh contributes about 05.45 and 05.24 per cent in area and production respectively of potato in the country. During 2013-14, productivity of Gujarat was (29750 kg/ha) highest in India and Madhya Pradesh was at 6thposition with 21116 kg/ha (Agricultural Statistics at a Glance, 2015) [1].

In Potato weed control plays a crucial role in influencing the growth and yield of potato crops. Effective weed management not only minimizes competition for essential resources but also mitigates potential negative impacts on potato plants. This introduction explores the various weed control measures and their implications on the growth and ultimate yield of potato crops, shedding light on the intricate relationship between weed presence and agricultural productivity.

Methods and Materials
The experiment was conducted on "Effect of weed management practices on weeds, growth and yield of potato (*Solanum tuberosum* L.) under organic farming ".

The field experiment was conducted at the Directorate of weed science Research (DWSR) Centre, College of Agriculture, (RVSKVV) Gwalior (M.P.) during the *rabi* season of 2016-2017. The experiment was laid out in randomized block design with 10 treatments replicated three times. The treatments consisted of T_1 White plastic mulch (50 µm), T_2 Black plastic mulch (50 µm), T_3 Straw mulching at 5 DAP (5 t ha^{-1}), T_4 One HW at 20 DAP + Straw mulching at 25 DAP (5 t ha^{-1}), T_5 Two hand hoeing at 20 and 40 DAP, T_6 Two hand weeding at 20 and 40 DAP, T_7 HW at 20 DAP + hoeing at 40 DAP, T_8 Metribuzin @ 500 g/ha pre emergence, T_9 Metribuzin @ 500 g/ha pre emergence + 1HW at 40 DAP, T_{10} Weedy check. Potato variety K. jyoti was sown at the seed rate of 25 q/ha in row of 60 cm apart with a basal dose of 180 N + 80 P_2O5 + 120 K_2O kg/ha through urea, SSP, muriate of potash. The crop was sown on 22 Oct. 2016 and harvested on 15 Feb. 2017. The various weed studies data *i.e.* Weed flora, Species wise weed population at 25, 40 DAP and harvest, Dry matter of broad and narrow leaf weeds at 40 DAP, Dry matter of total weeds at 40 DAP and weed index and weed control efficiency (%).

Result and discussion

1. Weed flora

The major broad leaf weed species found in the experimental plots were 4 *viz*., Chenopodium album, Anagallis arvensis, Spergula arvensis and Medicago hispida. The narrow leaf weed species found in the experimental plots were 2 *viz*. Cyperus rotundus and Phalaris minor. These species were most dominant in Gwalior region. These results are accordance with Sharma *et al*. (2004), Tomar *et al*. (2008) [8], and Arora *et al.* (2009) [2].

2. Weed population /m^2

The population of broad leaf weed species *viz*., *Chenopodium album*, *Anagallis arvensis*, *Spergula arvensis* and *Medicago hispida* and narrow leaf weed species *viz*., *Cyperus rotundus* and *Phalaris minor were* reduced drastically with use of different weed control methods . At early stage, Lowest weed population of weeds was recorded in T_4 (One HW at 20 DAP + Straw mulching at 25 DAP (5 t ha^{-1})) treatment results are accordance with Kosterna *et al*. (2014) [5] who concluded that application of straw mulch at the beginning of growing period of vegetable reduced in number and mass of weed. The higher density of *Cyperus rotundus* may be due to the fact that it belongs to C4 plant and has quick germination and survival capacity as well as the greater competitive ability than the other weeds. At At 40DAP, harvest stage of crop growth, lowest weed population of weeds was recorded in T_6 (Two hand weeding at 20 and 40 DAP) followed T_9 (Metribuzin @ 500 g/ha pre emergence + 1HW at 40 DAP), T_7, (HW at 20 DAP + hoeing at 40 DAP), These results are in confirmity of the results reported by Sandyan *et al*. (1989) [7], Khurana *et al.* (1992) [4] and Yadav *et al*. (2014) [9] most effective control of broad leaf as well as narrow leaf weeds over other treatments at 40DAP and harvest. However the weed population was recorded high after weedy under treatment comprised of white and black plastic mulching because of inter row laying of the polythene sheets. This has covered in space of furrow and allowed weeds growth are ridges intra row spaces, hence weed control efficiency was obtained with black and white plastic mulch lowest.

Species wise weed population

(i) *Cyperus rotundus*

Table 1: Effect of different weed control measures on population of *Cyperus rotundus* at successive crop growth stages

Treatments	Symbol	*Cyperus rotundus* /m^2		
		25 DAS	50 DAS	At harvest
White plastic mulch (50 µm)	T_1	9.65 (93.33)	10.22 (104.0)	11.57 (133.33)
Black plastic mulch (50 µm)	T_2	7.66 (58.67)	9.89 (97.33)	11.20 (125.0)
Straw mulching at 5 DAP (5 t ha^{-1})	T_3	10.43 (111.33)	9.81 (96.0)	10.88 (118.33)
One HW at 20 DAP + Straw mulching at 25 DAP (5 t ha^{-1})	T_4	7.59 (57.33)	7.46 (55.33)	8.15 (66.0)
Two hand hoeing at 20 and 40 DAP	T_5	8.31 (70.00)	9.77 (95.33)	11.11 (123.33)
Two hand weeding at 20 and 40 DAP	T_6	7.45 (55.33)	5.77 (33.33)	6.52 (42.33)
HW at 20 DAP + hoeing at 40 DAP	T_7	7.77 (61.33)	9.40 (88.0)	10.79 (116.0)
Metribuzin @ 500 g/ha pre emergence	T_8	14.47 (209.33)	10.15 (102.67)	11.53 (132.67)
Metribuzin @ 500 g/ha pre emergence + 1HW at 40 DAP	T_9	15.08 (227.33)	7.82 (61.33)	8.89 (79.33)
Weedy check	T_{10}	17.64 (312.0)	15.08 (227.33)	14.33 (205.33)
S.E.(m) ±		0.74	0.34	0.37
C.D. (at 5%)		2.19	1.02	1.10
Transformation		Log(X)	Log(X)	Log(X)

Figure in parenthesis indicate the original values.

ii) *Chenopodium album*

Table 2: Effect of different weed control measures on population of *Chenopodium album* at successive crop growth stages

Treatments	Symbol	*Chenopodium album* /m^2		
		25 DAS	40 DAS	At harvest
White plastic mulch (50 µm)	T_1	14.19 (201.33)	10.93 (119.33)	12.31 (151.67)
Black plastic mulch (50 µm)	T_2	13.58 (184.0)	10.08 (101.33)	11.37 (129.0)
Straw mulching at 5 DAP (5 t ha^{-1})	T_3	12.48 (155.33)	8.68 (75.0)	9.85 (96.67)
One HW at 20 DAP + Straw mulching at 25 DAP (5 t ha^{-1})	T_4	9.43 (88.67)	7.08 (49.67)	8.02 (64.0)
Two hand hoeing at 20 and 40 DAP	T_5	13.80 (191.33)	9.39 (88.0)	10.69 (114.33)
Two hand weeding at 20 and 40 DAP	T_6	9.09 (82.67)	5.29 (27.67)	5.97 (35.33)
HW at 20 DAP + hoeing at 40 DAP	T_7	9.82 (96.0)	7.93 (62.67)	9.05 (81.67)
Metribuzin @ 500 g/ha pre emergence	T_8	0.71 (0.0)	2.11 (5.00)	2.54 (7.67)
Metribuzin @ 500 g/ha pre emergence + 1HW at 40 DAP	T_9	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)
Weedy check	T_{10}	19.15 (367.33)	16.95 (287.0)	16.01 (256.33)
S.E.(m) ±		0.37	0.37	1.44
C.D. (at 5%)		1.10	1.11	0.48
Transformation		Log(x+1)	Log(x+1)	Log(x+1)

Figure in parenthesis indicate the original values.

iii) *Phalaris minor*

Table 3: Effect of different weed control measures on population of *Phalaris minor* at successive crop growth stages

Treatments	Symbol	*Phalaris minor* /m^2		
		25 DAS	40 DAS	At harvest
White plastic mulch (50 µm)	T_1	10.70 (114.67)	8.18 (66.67)	11.70 (137.33)
Black plastic mulch (50 µm)	T_2	10.25 (104.67)	7.30 (53.33)	11.26 (126.33)
Straw mulching at 5 DAP (5 t ha^{-1})	T_3	9.61 (95.33)	6.80 (46.67)	10.75 (118.33)
One HW at 20 DAP + Straw mulching at 25 DAP (5 t ha^{-1})	T_4	9.19 (84.0)	9.19 (84.0)	10.04 (100.33)
Two hand hoeing at 20 and 40 DAP	T_5	11.13 (124.0)	6.78 (45.67)	10.97 (120.0)
Two hand weeding at 20 and 40 DAP	T_6	7.05 (50.0)	3.42 (11.33)	7.72 (60.0)
HW at 20 DAP + hoeing at 40 DAP	T_7	9.75 (97.33)	5.96 (35.33)	10.63 (113.33)
Metribuzin @ 500 g/ha pre emergence	T_8	9.15 (83.33)	5.08 (25.67)	10.03 (100.33)
Metribuzin @ 500 g/ha pre emergence + 1HW at 40 DAP	T_9	7.97 (64.67)	3.76 (13.67)	8.71 (77.33)
Weedy check	T_{10}	13.23 (174.67)	11.99 (143.33)	12.67 (160.0)
S.E.(m) ±		0.76	0.37	0.69
C.D. (at 5%)		2.26	1.10	2.04
Transformation		Log(X)	Log(X)	Log(X)

Figure in parenthesis indicate the original values.

iv) *Anagallis arvensis*

Table 4: Effect of different weed control measures on population of *Anagallis arvensis* at successive crop growth stages

Treatments	Symbol	*Anagallis arvensis* /m^2		
		25 DAS	40 DAS	At harvest
White plastic mulch (50 µm)	T_1	4.15 (17.67)	4.26 (18.0)	4.48 (19.67)
Black plastic mulch (50 µm)	T_2	4.06 (16.67)	3.92 (15.0)	4.15 (17.0)
Straw mulching at 5 DAP (5 t ha^{-1})	T_3	3.86 (14.67)	3.66 (13.0)	3.92 (15.0)
One HW at 20 DAP + Straw mulching at 25 DAP (5 t ha^{-1})	T_4	3.42 (11.33)	3.06 (9.0)	3.52 (12.0)
Two hand hoeing at 20 and 40 DAP	T_5	4.54 (20.67)	3.84 (14.33)	4.01 (16.0)
Two hand weeding at 20 and 40 DAP	T_6	3.60 (12.67)	2.06 (4.67)	2.77 (7.67)
HW at 20 DAP + hoeing at 40 DAP	T_7	4.20 (17.67)	3.48 (11.67)	3.80 (14.0)
Metribuzin @ 500 g/ha pre emergence	T_8	0.71 (0.0)	1.71 (3.0)	2.10 (4.0)
Metribuzin @ 500 g/ha pre emergence + 1HW at 40 DAP	T_9	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)
Weedy check	T_{10}	5.77 (33.33)	6.18 (38.0)	5.76 (33.0)
S.E.(m) ±		0.38	0.38	0.29
C.D. (at 5%)		1.12	1.14	0.87
Transformation		Log X+1	Log X+1	Log X+1

v) *Spergula arvensis*

Table 5: Effect of different weed control measures on population of *Spergula arvensis* at successive crop growth stages

Treatments	Symbol	*Spergula arvensis* /m^2		
		25 DAS	40 DAS	At harvest
White plastic mulch (50 µm)	T_1	4.72 (22.33)	4.47 (19.67)	4.40 (19.0)
Black plastic mulch (50 µm)	T_2	4.60 (20.67)	4.29 (18.0)	4.04 (16.0)
Straw mulching at 5 DAP (5 t ha^{-1})	T_3	4.52 (20.00)	3.89 (15.0)	3.77 (14.0)
One HW at 20 DAP + Straw mulching at 25 DAP (5 t ha^{-1})	T_4	3.92 (15.00)	2.91 (8.0)	3.42 (11.33)
Two hand hoeing at 20 and 40 DAP	T_5	5.10 (26.00)	3.84 (14.33)	3.93 15.0)
Two hand weeding at 20 and 40 DAP	T_6	3.53 (12.00)	2.50 (6.0)	3.23 (10.0)
HW at 20 DAP + hoeing at 40 DAP	T_7	4.28 (18.00)	3.62 (12.67)	3.72 (13.33)
Metribuzin @ 500 g/ha pre emergence	T_8	0.71 (0.0)	1.77 (3.33)	2.06 (4.67)
Metribuzin @ 500 g/ha pre emergence + 1HW at 40 DAP	T_9	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)
Weedy check	T_{10}	5.69 (32.00)	5.98 (35.33)	5.80 (33.33)
S.E.(m) ±		0.29	0.31	0.33
C.D. (at 5%)		0.87	0.92	0.98
Transformation		Log X+1	Log X+1	Log X+1

vii) *Medicago hispida*

Table 6: Effect of different weed control measures on population of *Medicago hispida* at successive crop growth stages

Treatments	Symbol	*Medicago hispida* /m^2		
		25 DAS	40 DAS	At harvest
White plastic mulch (50 µm)	T_1	4.44 (19.33)	3.96 (15.33)	4.29 (18.67)
Black plastic mulch (50 µm)	T_2	4.06 (17.33)	3.64 (13.0)	4.12 (16.67)
Straw mulching at 5 DAP (5 t ha^{-1})	T_3	3.91 (15.33)	3.56 (12.33)	3.80 (14.0)
One HW at 20 DAP + Straw mulching at 25 DAP (5 t ha^{-1})	T_4	3.08 (9.0)	2.99 (8.67)	3.36 (11.0)
Two hand hoeing at 20 and 40 DAP	T_5	4.10 (16.67)	3.48 (11.67)	3.92 (15.0)
Two hand weeding at 20 and 40 DAP	T_6	2.90 (8.0)	2.18 (4.33)	3.18 (9.67)
HW at 20 DAP + hoeing at 40 DAP	T_7	3.09 (9.33)	3.24 (10.33)	3.66 (13.0)
Metribuzin @ 500 g/ha pre emergence	T_8	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)
Metribuzin @ 500 g/ha pre emergence + 1HW at 40 DAP	T_9	0.71 (0.0)	0.71 (0.0)	(0.0)
Weedy check	T_{10}	5.17 (27.33)	5.78 (33.0)	5.39 (28.67)
S.E.(m) ±		0.45	0.20	0.15
C.D. (at 5%)		1.34	0.60	0.44
Transformation		Log X+1	Log X+1	Log X+1

viii) Other weed

Table 7: Effect of different weed control measures on population of other weed at successive crop growth stages

Treatments	Symbol	Other weed /m^2		
		25 DAS	40 DAS	At harvest
White plastic mulch (50 µm)	T_1	3.32 (11.33)	4.17 (17.0)	4.73 (22.0)
Black plastic mulch (50 µm)	T_2	3.32 (10.67)	3.90 (15.0)	4.56 (20.33)
Straw mulching at 5 DAP (5 t ha^{-1})	T_3	3.91 (15.33)	3.50 (12.0)	4.37 (18.67)
One HW at 20 DAP + Straw mulching at 25 DAP (5 t ha^{-1})	T_4	2.96 (8.33)	2.96(8.33)	3.31 (11.0)
Two hand hoeing at 20 and 40 DAP	T_5	4.02 (16.0)	3.80 (14.0)	4.29 (18.0)
Two hand weeding at 20 and 40 DAP	T_6	2.73 (7.0)	2.50 (6.0)	3.06 (9.0)
HW at 20 DAP + hoeing at 40 DAP	T_7	3.00 (8.67)	3.28 (10.33)	3.52 (12.0)
Metribuzin @ 500 g/ha pre emergence	T_8	2.41 (5.33)	3.18 (9.67)	2.90 (8.0)
Metribuzin @ 500 g/ha pre emergence + 1HW at 40 DAP	T_9	2.32 (5.0)	2.73 (7.0)	2.50 (6.0)
Weedy check	T_{10}	5.22 (27.0)	5.22 (27.0)	5.63 (31.33)
S.E.(m) ±		0.37	0.28	0.24
C.D. (at 5%)		1.09	0.82	0.72
Transformation		Log(X)	Log(X)	Log(X)

3. Weed dry weight (g/m^2)

All weed control treatments gave lower dry weight when compared with weedy check at 40 DAP. However, at 40 days after plantig dry matter of different weeds was not found in T_6 (Two hand weeding at 20 and 40 DAP) due to complete control of broad and narrow leaf weeds. The next effective treatment at stage of 40DAP, treatment T_9 (Metribuzin @ 500 g/ha pre emergence + 1HW at 40 DAP) resulted in significantly lower dry weight of broad and narrow leaf weeds over rest of all weed control treatments. Maximum dry matter of broad and narrow leaf weeds was recorded in weedy check. Under organic farming, Among the weed management practices, T_8 (Metribuzin @ 500 g/ha pre emergence) demonstrated a very effective mortality of broad leaf weeds resulting decline in dry matter accumulation of weed. Similar result also reported by Sandyan *et al.* (1989) [7], Khurana *et al.* (1992) [4] and Yadav *et al.* (2014) [9].

viii) Weed dry weight (g/m^2)

Table 8: Effect of different weed control measures on weed dry weight at 40 DAP

Treatments	Symbol	Weed dry weight /m^2		
		Narrow leaf weed	Broad leaf weed	Total
White plastic mulch (50 µm)	T_1	43.33	41.00	84.33
Black plastic mulch (50 µm)	T_2	41.00	39.00	80.00
Straw mulching at 5 DAP (5 t ha^{-1})	T_3	32.67	34.00	66.67
One HW at 20 DAP + Straw mulching at 25 DAP (5 t ha^{-1})	T_4	17.67	14.33	32.00
Two hand hoeing at 20 and 40 DAP	T_5	29.00	30.67	59.67
Two hand weeding at 20 and 40 DAP	T_6	15.67	12.67	28.33
HW at 20 DAP + hoeing at 40 DAP	T_7	20.00	20.67	40.67
Metribuzin @ 500 g/ha pre emergence	T_8	14.00	8.00	22.00
Metribuzin @ 500 g/ha pre emergence + 1HW at 40 DAP	T_9	10.00	5.00	15.00
Weedy check	T_{10}	110.00	160.67	270.67
S.E.(m) ±		3.97	2.88	4.63
C.D. (at 5%)		NS	NS	NS

ix) Weed control efficiency

x) Weed index

Table 9: Effect of different weed control measures on weed control efficiency at 50 DAS and weed index

Treatments	Symbol	Weed control efficiency (%)	Weed index (%)
White plastic mulch (50 µm)	T_1	68.84	55.43
Black plastic mulch (50 µm)	T_2	70.44	52.17
Straw mulching at 5 DAP (5 t ha^{-1})	T_3	75.37	50.00
One HW at 20 DAP + Straw mulching at 25 DAP (5 t ha^{-1})	T_4	88.18	4.35
Two hand hoeing at 20 and 40 DAP	T_5	77.96	43.48
Two hand weeding at 20 and 40 DAP	T_6	89.53	-
HW at 20 DAP + hoeing at 40 DAP	T_7	84.98	13.04
Metribuzin @ 500 g/ha pre emergence	T_8	91.87	2.17
Metribuzin @ 500 g/ha pre emergence + 1HW at 40 DAP	T_9	94.46	8.70
Weedy check	T_{10}	--	59.78

4. Weed control efficiency and Weed index

Higher weed control efficiency was recorded in treatment T_6 (Two hand weeding at 20 and 40 DAP) (99.08%), followed by T_9 (Metribuzin @ 500 g/ha pre emergence + 1HW at 40 DAP) (98.76%). The higher weed control efficiency under these treatments was reflected through to lower dry weight of weeds. Similar results reported by Channappagoudar *et al.* (2007) [3] and Mukharjee *et al.* (2012) [6].

Weed index is indirectly related to the reduction in yield due to weed population and weed dry weight. Treatment T_6 (Two hand weeding at 20 and 40 DAP) and, T_9 (Metribuzin @ 500 g/ha pre emergence + 1HW at 40 DAP) was recorded minimum weed index, which was followed by T_7 (HW at 20 DAP + hoeing at 40 DAP). The highest weed index was noted in weedy check. Similar results reported by Channappagoudar *et al*. (2007) [3] and Mukharjee *et al.* (2012) [6].

Conclusions

On the basis of above findings, it may be concluded that weed reduced growth, yield attributes and ultimately tuber yield. Based on the result of this experiment two hand weeding at 20 and 40 DAP find out most effective weed management practice for potato under Gwalior region.

The maximum benefit cost ratio of 2.03 was obtained under treatment T_8 (Metribuzin @ 500 g/ha pre emergence) which was maximum among all the treatments and found economically superior than treatment T_9 (Metribuzin @ 500 g/ha pre emergence + 1 HW at 40 DAP) (2.02) and T_6 (two hand weeding at 20 and 40 DAP) (1.91) due to less treatment cost as compared to their cost of treatment.

References

1. Agri Stat. Agricultural Statistics at a glance, Government of India. 2015;16:0-240
2. Arora Asha, Tomar SS, Gole MK. Yield and quality of potato as influenced by weed management practices and their residual study in soil. Agric. Sci. Digest. 2009;29(2):1-3
3. Channappagoudar BB, Biradar NR, Bharmagoudar TD, Koti RV. Crop weed competition and chemical control of

weeds in potato. Karnataka J. Agric. Sci. 2007;20(4):715-718.
4. Khurana SC, Malik YS, Pandita ML. Herbicidal control of weeds in potato cv. Kufri Badshah-A note. Haryana J. hortic. Sci. 1992;21(3-4):314-315.
5. Kosterna E. The Effect Of Different Types Of Straw Mulches On Weed- Control In Vegetables Cultivation. Journal of Ecological Engineering. 2014;15(4):109-117.
6. Mukherjee PK, Rahaman S, Maity SK, Sinha B. Weed management in potato (*Solanum tuberosum* L.) J. Crop Weed. 2012;8(1):178-180.
7. Sandyan JS, Banerjee MK, Hooda RS. A study on the effect of chemical and cultural treatments on the weeds and yield of potatoes. Agric. Sci. Digest (Karnal). 1989;9(2):63-64.
8. Tomar SS, Rajput RL, Kushwala HS. Effect of weed management practices in potato (*Solanum tuberosum* L) Indian J. Weed Sci. 2008;40(384):187-190.
9. Yadav SK, Lal SS, Srivastava AK, Bag TK, Singh BP. Efficacy of chemical and non -chemical methods of weed management in rainfed potato (*Solanum tuberosum*). J. Prog. Agri. 2014;5(1):64-65.