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Nutrient and weed management practices influenced yield and weed dynamics in chickpea (*Cicer arietinum* L.)

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Abstract
Field experiment was carried out at Research Farm, Indira Gandhi Krishi Viswavidyalaya, Raipur (Chhattisgarh) during *Rabi* seasons of 2013-14 and 2014-15 to study the effect of nutrient management and weed management practices on yield and nutrient status. Application of 125% RDF showed the highest seed yield with 15.30 q ha^{-1} and 17.89 q ha^{-1}, respectively with mean of 16.60 q ha^{-1}; whereas, 150% RDF showed the highest stover yield of 18.24 q ha^{-1} and 21.15 q ha^{-1}, respectively with mean of 19.70 q ha^{-1}. Among weed management practices, the highest seed yield of 19.56 q $ha^{-1}$and 21.76 q ha^{-1} during 2013-14 and 2014-15, respectively with mean of 20.66 q ha^{-1}; stover yield of 21.04 and 23.77 q ha^{-1} during 2013-14 and 2014-15, respectively with mean of 22.41 q ha^{-1} were recorded under Metribuzin 0.4 kg/ha + Oxyfluorfen 0.3 kg/ha as PE. The predominant weed species recorded in the experimental field were *Medicago denticulata* and *Chenopodium album*. Minimum weed density, weed dry matter, minimum energy pondered by weeds and higher weed control efficiency was under 100% RDF. Among weed management practices, minimum weed density, weed dry matter, maximum weed control efficiency, weed index and minimum energy was pondered by weeds in pre-emergence application of metribuzin 0.4 kg ha^{-1} + oxyfluorfen 0.3 kg ha^{-1}.

Keywords: chickpea, nutrient, weed, energetics

Introduction
Pulses are the important food crop of the world because it provides good source of vegetable dietary protein, mostly in areas where economy does not support large scale production and utilization of animal protein. (Peerzada *et al*., 2014) [5]. Chickpea is one of the best sources of pulse in India. It is an excellent source of vitamins B6, vitamin C and Zinc. In India, it's area, production and productivity are 8.56 mha, 7.35 mt and 859 kg/ha, respectively (AICRP, 2010) [1]. In Chhattisgarh, chickpea is also one of the important pulses and occupies an area of 375.76 thousand ha with production and productivity of 402.06 thousand ton and 1070 kg/ha, respectively (Anonymous, 2013) [2].

Chickpea is a very poor competitor to weeds. Manual weeding is the common practice by farmers. But now a days there is scarcity of labourers and it is time consuming. Herbicides controls broad spectrum of weed species in pulses effectively. Usage of herbicides in proper way will control weeds during critical period of crop-weed competition. Fertilizers also play significant role in boosting up the production of pulses. Nitrogen is an essential macronutrient needed by all plants to thrive. Phosphorus and potassium are the nutrients required in large quantity for optimum growth and yield of pulses. Herbicides may change the weed dynamics and energy pondered by weeds.

The impact of nutrient doses and herbicides on weed dynamics and energetics of weeds has not been evaluated. So there is need to know the effect of herbicides and nutrient doses on weed dynamics and energetics of weeds. In light of the above the field experiment was carried out to find out the suitable herbicide and economical nutrient dose.

Materials and Methods
The present investigation on 'Effect of nutrient management and weed management practices on yield, nutrient content and uptake by late sown chickpea in rice based cropping system' was carried out during *Rabi* seasons of 2013-14 and 2014-15 at the Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) located between 21°4' N latitude and 81°39' E longitude with an altitude of 298 metre above mean sea level having sub tropical humid climate. The experimental soil was clayey (vertisol) with pH 7.12, EC 0.20 m mhos m^{-1},

low in available nitrogen (212.6 kg N ha^{-1}), medium in available phosphorus (12.50 kg P ha^{-1}), high in available potassium (300.3 kg K ha^{-1}) and organic carbon (0.48 %). The experiment was laid out in split plot design with three replications with a plot size of 4.8 m x 4.0 m. Main plot consisted of nutrient management *viz* (1) Recommended Dose of Fertilizers (20 kg N, 50 kg P_2O_5 and 30 kg K_2O ha^{-1}) (2) 125% RDF (25 kg N, 62.5 kg P_2O_5 and 37.5 kg K_2O ha^{-1}) (3) 150 % RDF (30 kg N, 75 kg P_2O_5 and 45 kg K_2O ha^{-1}). Sub plot consisted of seven weed management practices *viz.* (1) Metribuzin 0.4 kg/ha + Oxyfluorfen 0.3 kg/ha as PE (2) (Imazethapyr 35% + Imazamox 35%) 100 g/ha as PoE (3) (Pendimethalin 30 % EC + Imazethapyr 2%) 1.0 kg/ha as PE (4) Sulfentrazone 300 g/ha as PE (5) Oxyfluorfen 0.3 kg/ha as PE fb Imazethapyr 50 g/ha as PoE (6) Imazethapyr 50 g/ha as PE fb Metribuzin 0.3 kg/ha as PoE (7) Untreated control. Variety 'JG-226'

$$\text{Weed growth rate (g day}^{-1}\text{ m}^{-2}) = \frac{W_2 - W_1}{t_2 - t_1}$$

Where,

W_2 and W_1 = Dry matter production of weeds (g) at time interval, and t_2 and t_1 = Time interval in days

$$\text{WI (\%)} = \frac{\text{Maximum seed yield - Seed yield from treated plot}}{\text{Maximum seed yield}} \times 100$$

Mani *et al*. (1973) [4]

$$\text{WCE (\%)} = \frac{\text{DWC–DWT}}{\text{DWC}} \times 100$$

Where,

WCE = Weed control efficiency (%)

DWC = Dry weight of weeds in weedy check plot (g)

DWT = Dry weight of weeds in treated plot (g)

$$\text{Relative dry weight \%} = \frac{\text{Dry weight of given species}}{\text{Total dry weight of all species}} \times 100$$

$$\text{Relative density \%} = \frac{\text{Absolute density of a given species}}{\text{Total absolute density of all species}} \times 100$$

Energy pondered by weeds (MJ ha^{-1}) = Dry matter of weeds (g m^{-2}) x 4.3 (k.calg^{-1} weeds) x 41.68

All observations were statistically analysed as suggested by Gomez and Gomez (1984) [3].

Results and Discussion

Yield (q ha^{-1})

Table 1 shows that 125% RDF resulted in significantly higher seed yield of 15.30 q ha^{-1} and 17.89 q ha^{-1} during 2013-14 and 2014-15, respectively with mean of 16.60 q ha^{-1} compared to other nutrient management practices. Highest stover yield was obtained with 150% RDF *i.e.* 18.24 and 21.15 q ha^{-1} during 2013-14 and 2014-15, respectively with mean of 19.70 q ha^{-1}. The lowest seed yield was under 150% RDF *i.e.* 13.49 and 15.85 q ha^{-1} during 2013-14 and 2014-15, respectively with mean of 14.67 q ha^{-1} and lowest stover yield of 16.36 and 19.52 q ha^{-1} during 2013-14 and 2014-15, respectively with mean of 17.94 q ha^{-1} was under 100% RDF.

This may be due to fact that more amount of nutrients significantly reduced grain yield as a result of excessive vegetative growth at the expense of pod formation. Higher stover yield was due to higher dry accumulation of plant.

Weed management practices exerted significant impact on yield of chickpea. The highest seed yield of 19.56 and 21.76 q ha^{-1} during 2013-14 and 2014-15, respectively with mean of 20.66 q ha^{-1} and stover yield of 21.04 and 23.77 q ha^{-1} during 2013-14 and 2014-15, respectively with mean of 22.41 q ha^{-1} was under Metribuzin 0.4 kg/ha + Oxyfluorfen 0.3 kg/ha as PE. The lowest seed yield of 7.01 and 8.41 q ha^{-1} during 2013-14 and 2014-15, respectively with mean of 7.71 q ha^{-1} and stover yield of 11.70 and 14.52 q ha^{-1} during 2013-14 and 2014-15, respectively with mean of 13.11 q ha^{-1}.

Higher seed and stover yield under above treatments was due to the weed managed at critical period and early crop growth, higher dry matter production, high growth and ultimately high yield. Lower weed population and higher weed control efficiency also resulted in higher seed and stover yield.

The interaction effect of nutrient management and weed management practices was non-significant on stover yield.

Weed flora associated with chickpea crop

The predominant weed species recorded in the experimental field were *Medicago denticulata* and *Chenopodium album*.

Dominated weeds in experimental field

S. No.	Botanical name	Family	English name	Types of weeds
1.	*Medicago denticulate* Willd.	Fabaceae	Bur clover	Broad leaf
2.	*Chenopodium album* L.	Chenopodiaceae	Lamb's Quarters	Broad leaf

The most predominant weeds in the experimental fields was found *Medicago denticulata*.

Total weed density and dry matter

Total weed density as affected by different weed management practices are presented in Table 2.

In main plots, nutrient management showed significant effect on total weed density at all intervals. 100% RDF showed minimum total weed density and total weed drymatter at all intervals during both the years as well as on mean data basis. The maximum weed density and dry matter was under 150% RDF due to more supply of nutrients.

The crop was mainly infested with *Medicago denticulata* and *Chenopodium album*. Density of *Medicago denticulata* and *Chenopodium album* were lower under 100% RDF followed by 125% RDF. Maximum weed density was under 150% RDF.

Among weed management practices, the maximum density and dry matter of weeds was observed under untreated control. At 45 DAS minimum weed density and dry matter was under imazethapyr 50 gha^{-1} as PE fb metribuzin 0.3 kg ha^{-1} as PoE followed by pre-emergence application of metribuzin 0.4 kg ha^{-1} + oxyfluorfen 0.3 kg ha^{-1}. At harvest minimum weed density and dry matter was under pre-emergence application of metribuzin 0.4 kg ha^{-1} + oxyfluorfen 0.3 kg ha^{-1} which was comparable with oxyfluorfen 0.3 kg ha^{-1} as PE fb imazethapyr 50 g ha^{-1} as PoE.

Interaction between nutrient and weed management practices on weed density and dry matter of chickpea was significant. At 45 DAS minimum weed density and dry matter was under interaction of 100% RDF and imazethapyr 50 gha^{-1} as PE fb

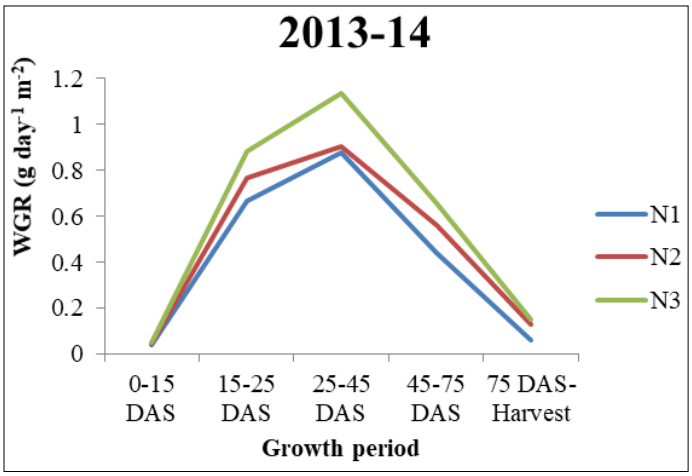
metribuzin 0.3 kg ha^{-1} as PoE, 125% RDF and imazethapyr 50 gha^{-1} as PE fb metribuzin 0.3 kg ha^{-1} as PoE, 150% RDF and imazethapyr 50 gha^{-1} as PE fb metribuzin 0.3 kg ha^{-1} as PoE. At harvest minimum weed density and dry matter was under interaction of 100% RDF and pre-emergence application of metribuzin 0.4 kg ha^{-1} + oxyfluorfen 0.3 kg ha^{-1} which was comparable with 100% RDF and oxyfluorfen 0.3 kg ha^{-1} as PE fb imazethapyr 50 g ha^{-1} as PoE.

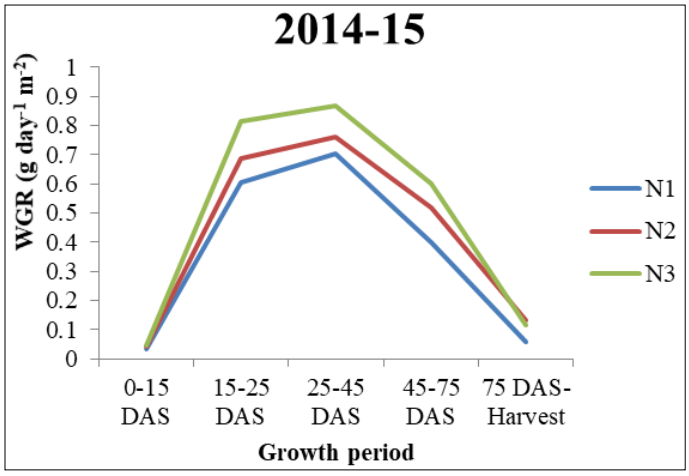
Weed growth rate (g day^{-1} m^{-2})

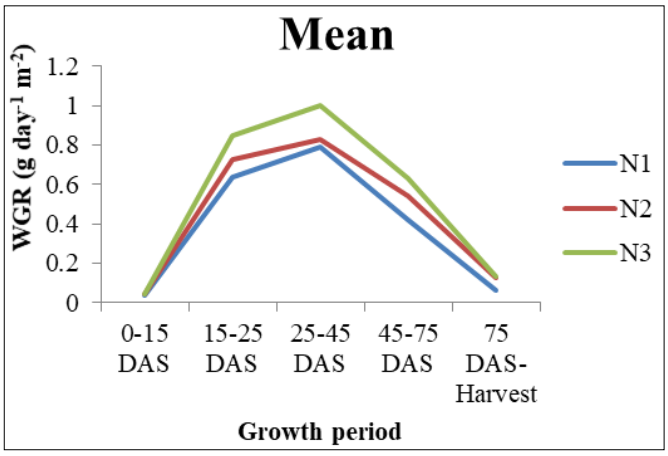
Data on effect of nutrient and weed management practices on weed growth rate are depicted in Fig. 1.

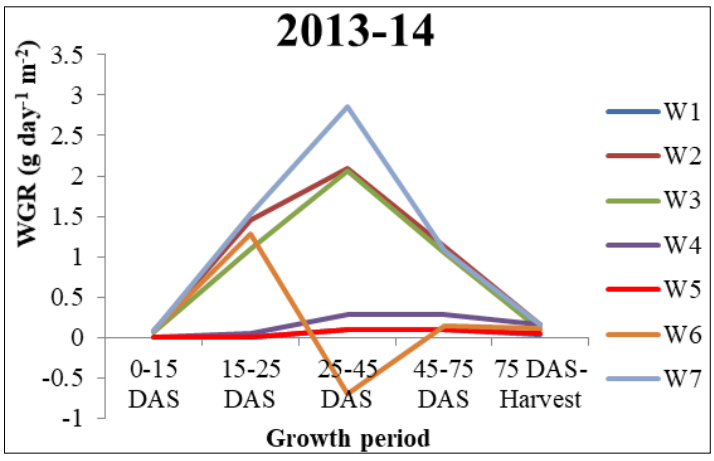
Weed growth rate was increased with the advancement in the age of crop upto 45 DAS and showed decreasing trend thereafter upto harvest. Nutrient management showed significant effect on weed growth rate at all intervals. Minimum weed growth rate was under 100% RDF during both the years as well as on mean data basis. It was comparable to 125% RDF at 0-15 and 25-45 DAS; 150% RDF at 0-15 DAS. However, at 15-25 DAS, 45-75 DAS and 75 DAS- harvest it was followed by 125% RDF.

Among weed management practices, during both the years as well as on mean data basis there was no weed growth rate in pre-emergence application of metribuzin 0.4 kg ha^{-1} + oxyfluorfen 0.3 kg ha^{-1},pre-emergence application of sulfentrazone 300 g ha^{-1} and oxyfluorfen 0.3 kg ha^{-1} as PE fb imazethapyr 50 g ha^{-1} as PoE at 0-15 DAS. At 15-25 DAS there was no weed growth in pre-emergence application of metribuzin 0.4 kg ha^{-1} + oxyfluorfen 0.3 kg ha^{-1} and oxyfluorfen 0.3 kg ha^{-1} as PE fb imazethapyr 50 g ha^{-1} as PoE. Negative weed growth rate was observed under imazethapyr 50 gha^{-1} as PE fb metribuzin 0.3 kg ha^{-1} as PoE at 25-45 DAS followed by pre-emergence application of metribuzin 0.4 kg ha^{-1} + oxyfluorfen 0.3 kg ha^{-1} and oxyfluorfen 0.3 kg ha^{-1} as PE fb imazethapyr 50 g ha^{-1} as PoE. At 45-75 DAS and 75 DAS- harvest minimum weed growth rate was under pre-emergence application of metribuzin 0.4 kg ha^{-1} + oxyfluorfen 0.3 kg ha^{-1} which was comparable with oxyfluorfen 0.3 kg ha^{-1} as PE fb imazethapyr 50 g ha^{-1} as PoE and imazethapyr 50 gha^{-1} as PE fb metribuzin 0.3 kg ha^{-1} as PoE during both the years as well as on mean data basis except at 75 DAS-harvest during 2013-14.









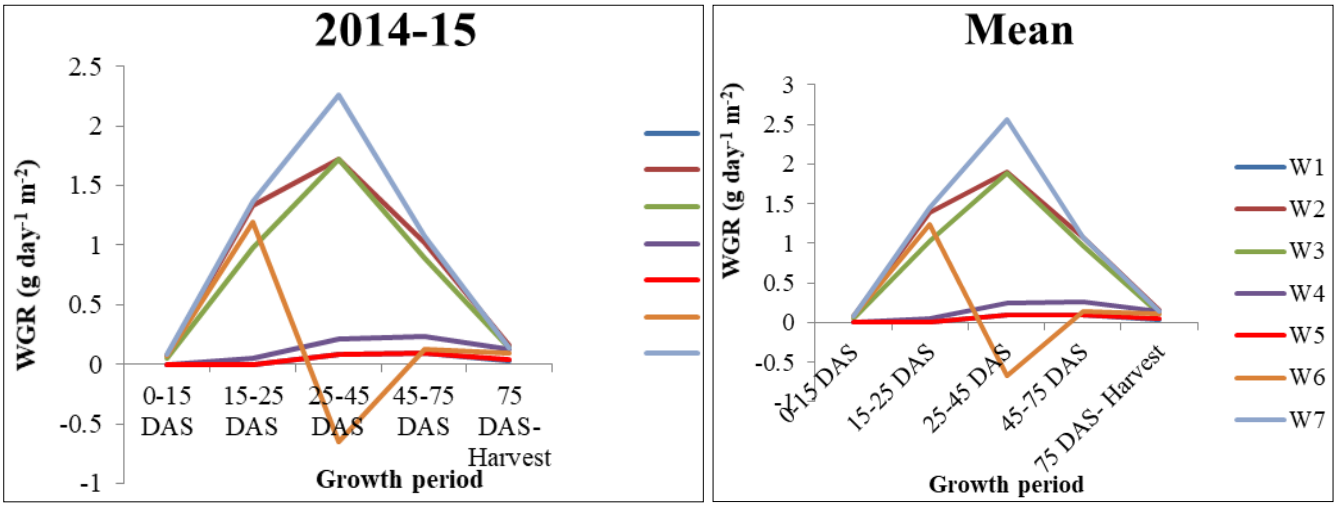


Fig 1: Weed growth rate (g day^{-1} m^{-2}) in chickpea as influenced by nutrient and weed management practices.

Weed Index (%)

The data pertaining to weed index of chickpea are presented in Table 1. Nutrient management has no significant effect on weed index.

All the weed management treatments except imazethapyr 50 gha^{-1} as PE fb metribuzin 0.3 kgha^{-1} as PoE where weeds were managed by application of herbicides proved significantly superior to untreated control in alleviating weed index. Pre-emergence application of metribuzin 0.4 kg ha^{-1} + oxyfluorfen 0.3 kg ha^{-1} proved to be the best over rest of the weed management practices in minimizing weed index. Oxyfluorfen 0.3 kg ha^{-1} as PE fb imazethapyr 50 g ha^{-1} as PoE obtained minimum weed index of 10.66% and 5.50% during 2013-14 and 2014-15, respectively with mean of 8.08 %. This clearly indicated that weeds were controlled effectively under oxyfluorfen 0.3 kg ha^{-1} as PE fb imazethapyr 50 g ha^{-1} as PoE. Imazethapyr 50 gha^{-1} as PE fb metribuzin 0.3 kg ha^{-1} as PoE was found significantly inferior to rest of the treatments in case of weed index. Weed index of 36.03 % and 30.81 % during 2013-14 and 2014-15, respectively with mean of 323.4 % was recorded in untreated control. Although seed yield reduction was higher in imazethapyr 50 g ha^{-1} as PE fb metribuzin 0.3 kg ha^{-1} as PoE than untreated control it was due to phytotoxic effect of metribuzin and not due to weeds.

Interaction between nutrient and weed management practices was found significant on weed index. Minimum weed index was under interaction of 100% RDF and oxyfluorfen 0.3 kg ha^{-1} as PE fb imazethapyr 50 g ha^{-1} as PoE with 10.10% and 4.21% during 2013-14 and 2014-15, respectively with mean of 7.16%. Maximum weed index was under interaction of 150% RDF and imazethapyr 50 g ha^{-1} as PE fb metribuzin 0.3 kg ha^{-1} as PoE.

Weed control efficiency (%)

The data pertaining to weed control efficiency of chickpea are presented in Table 1.

At 45 and 75 DAS and at harvest significant effect of nutrient management on weed control efficiency was observed. Significantly higher weed control efficiency was observed in 100% RDF and it was significantly superior to other nutrient management practices. 150% RDF showed lower weed control efficiency.

Among herbicides, at 45 DAS, the maximum weed control efficiency was under imazethapyr 50 gha^{-1} as PE fb metribuzin 0.3 kgha^{-1} as PoE. At harvest, the maximum weed control efficiency was under pre-emergence application of metribuzin 0.4 kg ha^{-1} + oxyfluorfen 0.3 kg ha^{-1}.

Interaction between nutrient and weed management practices were found significant on weed control efficiency.

Table 1: Performance of nutrient management and weed management on yield, Weed Index and Weed Control Efficiency in chickpea

Treatments	Seed yield (q ha^{-1})			Stover yield (q ha^{-1})			Weed Index (%)			Weed control efficiency (%)					
										45DAS			Harvest		
	2013-14	2014-15	2013-14	2013-14	2013-14	2013-14	2013-14	2014-15	Mean	2013-14	2014-15	Mean	2013-14	2014-15	Mean
Nutrient management															
N1	14.88	17.13	16.01	16.36	19.52	17.94	25.05	22.13	23.59	62.97	63.05	63.01	58.45	59.54	59.00
N2	15.30	17.89	16.60	18.08	20.98	19.53	25.36	22.45	23.91	60.90	60.41	61.16	55.71	56.47	56.09
N3	13.49	15.85	14.67	18.24	21.15	19.70	26.38	21.63	24.01	59.59	58.11	58.85	54.12	54.32	54.22
SEm±	0.32	0.34	0.31	0.33	0.29	0.31	0.55	0.95	0.75	0.51	0.32	0.33	0.50	0.17	0.30
CD (P= 0.05)	1.25	1.33	1.22	1.30	1.15	1.23	NS	NS	NS	1.99	1.25	1.28	1.97	0.66	1.19
Weed management															
W1	19.56	21.76	20.66	21.04	23.77	22.41	0.00	0.00	0.00	97.53	97.41	97.47	94.33	94.52	94.43
W2	12.97	15.74	14.36	15.83	19.45	17.64	33.75	27.69	30.72	22.35	18.04	20.20	11.59	11.97	11.78
W3	15.75	17.98	16.87	18.76	21.62	20.19	19.48	17.33	18.41	21.48	18.47	19.98	19.72	20.94	20.33
W4	16.63	19.18	17.91	19.72	22.55	21.14	14.90	11.73	13.32	91.71	92.40	92.06	81.34	83.31	82.33
W5	17.47	20.58	19.03	20.09	22.92	21.51	10.66	5.50	8.08	97.33	97.33	97.33	93.68	94.10	93.89
W6	5.01	6.41	5.71	9.70	12.52	11.11	64.36	61.43	62.90	100.00	100.00	100.00	92.70	92.57	92.29
W7	12.51	15.04	13.78	15.78	19.01	17.40	36.03	30.81	33.42	0.00	0.00	0.00	0.00	0.00	0.00

SEm±	0.42	0.34	0.33	0.43	0.37	0.39	1.72	1.31	1.43	0.53	0.73	0.50	0.60	0.90	0.64
CD (P= 0.05)	1.20	0.97	0.94	1.24	1.07	1.11	4.93	3.77	4.11	1.53	2.10	1.44	1.71	2.58	1.85
I X W	S	S	S	NS	NS	NS	S	S	S	S	S	S	S	S	S

N1- 100% RDF, N2- 125% RDF, N3- 150% RDF, W1- Metribuzin 0.4 kg/ha + Oxyfluorfen 0.3 kg/ha as PE, W2- (Imazethapyr 35% + Imazamox 35%) 100 g/ha as PoE, W3- (Pendimethalin 30 % EC + Imazethapyr 2%) 1.0 kg/ha as PE, W4- Sulfentrazone 300 g/ha as PE, W5- Oxyfluorfen 0.3 kg/ha as PE fb Imazethapyr 50 g/ha as PoE, W6- Imazethapyr 50 g/ha as PE fb Metribuzin 0.3 kg/ha as PoE, W7- Untreated control

Table 2: Effect of nutrient and weed management on total weed density and total weed drymatterin chickpea

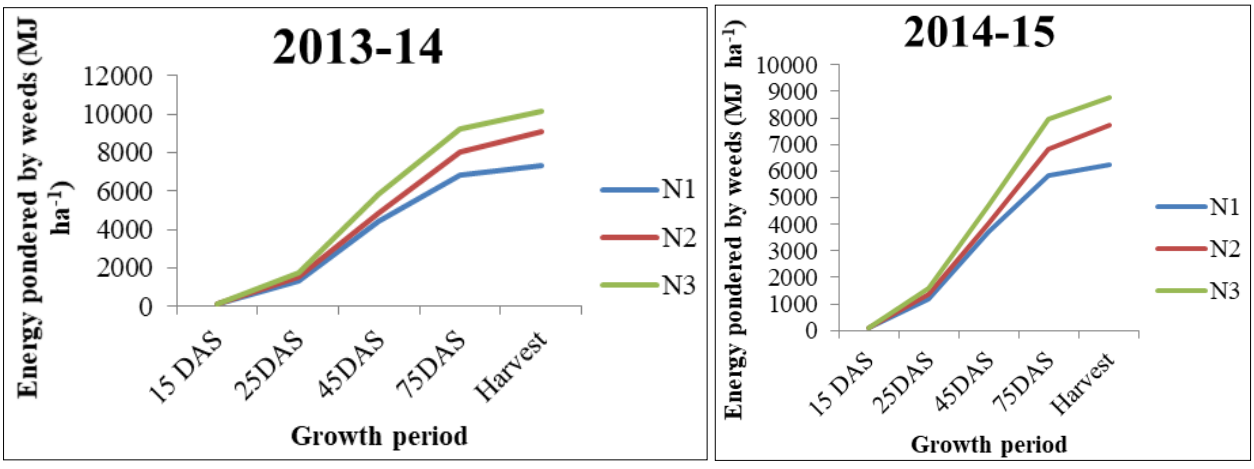
Treatments	Total weed density (no. m^{-2})						Total weed dry matter (g m^{-2})					
	45 DAS			At harvest			45 DAS			At harvest		
	2013-14	2014-15	Mean	2013-14	2014-15	Mean	2013-14	2014-15	Mean	2013-14	2014-15	Mean
Nutrient management												
N1	4.74	4.52	4.63	5.49	5.40	5.44	4.07	3.72	3.90	5.45	5.06	5.29
	(32.57)	(29.10)	(30.83)	(38.86)	(37.81)	(38.33)	(24.73)	(20.57)	(22.65	(40.85)	(34.76)	(37.81)
N2	5.33	5.27	5.30	6.27	6.17	6.22	4.27	3.91	4.09	6.37	5.88	6.12
	(37.76)	(37.14)	(37.45)	(47.29)	(46.00)	(46.64)	(26.88)	(22.41)	(24.64)	(50.53)	(43.03)	(46.78)
N3	5.62	5.51	5.57	6.87	6.62	6.74	4.83	4.40	4.62	6.78	6.22	6.50
	(42.48)	(40.48)	(41.48)	(54.29)	(52.67)	(53.48)	(32.25)	(26.16)	(29.21)	(56.24)	(48.63)	(52.44)
SEm±	0.08	0.04	0.05	0.05	0.08	0.06	0.05	0.07	0.06	0.05	0.05	0.05
CD (P=0.05)	0.30	0.14	0.20	0.19	0.32	0.22	0.20	0.27	0.23	0.18	0.20	0.19
CV (%)	6.69	3.21	4.54	3.58	6.17	4.21	5.30	7.93	6.36	3.38	4.04	3.64
Weed management												
W1	2.33	2.34	2.33	2.71	2.69	2.70	1.69	1.57	1.63	2.71	2.48	2.59
	(4.33)	(4.67)	(4.50	(6.22)	(6.67)	(6.44)	(2.05)	(1.64)	(1.84)	(6.71)	(5.52)	(6.12)
W2	8.76	8.48	8.62	9.45	9.45	9.45	7.64	7.05	7.34	9.99	9.29	9.64
	(76.00)	(71.44)	(73.72)	(88.67)	(88.89)	(88.78)	(57.62)	(48.85)	(53.24)	(99.21)	(85.50)	(92.36)
W3	8.42	8.25	8.34	9.21	8.95	9.08	7.40	6.77	7.09	9.64	8.82	9.23
	(70.00)	(67.22)	(68.61)	(82.33)	(79.44)	(80.89)	(53.83)	(45.00)	(49.42)	(89.65)	(77.28)	(83.47)
W4	4.23	3.98	4.10	5.50	4.95	5.23	2.67	2.34	2.50	4.65	4.15	4.40
	(17.33)	(15.33)	(16.33)	(29.44)	(23.78)	(26.61)	(6.26)	(4.64)	(5.45)	(20.87)	(16.40)	(18.63)
W5	2.33	2.34	2.34	2.80	2.72	2.76	1.69	1.58	1.64	2.79	2.54	2.67
	(4.89)	(4.67)	(4.78)	(6.56)	(6.67)	(6.61)	(2.04)	(1.69)	(1.87)	(7.14)	(5.83)	(6.48)
W6	1.00	1.00	1.00	3.66	3.58	3.62	1.00	1.00	1.00	3.15	2.87	3.01
	(0.00)	(0.00)	(0.00)	(12.67)	(12.11)	(12.39)	(0.00)	(0.00)	(0.00)	(9.04)	(7.27)	(8.16)
W7	9.56	9.30	9.43	10.13	10.09	10.11	8.64	7.77	8.21	10.61	9.90	10.25
	(90.67)	(85.67)	(88.17)	(101.78)	(100.89)	(101.33)	(73.88)	(59.50)	(66.69)	(111.84)	(97.18)	(104.51)
SEm±	0.05	0.05	0.04	0.07	0.08	0.05	0.04	0.05	0.04	0.05	0.06	0.05
CD (P=0.05)	0.15	0.14	0.11	0.20	0.23	0.16	0.11	0.14	0.11	0.15	0.17	0.15
CV (%)	3.08	2.79	2.15	3.36	3.93	2.67	2.61	3.68	2.67	2.57	3.05	2.63
I X W	S	S	S	S	S	S	S	S	S	S	S	S

Figures in parenthesis are the original values. Data transformed to square root transformation $\sqrt{X+1}$

Energy pondered by weeds (MJ ha^{-1})

The data pertaining to energy pondered by weed sare presented in Fig. 2. Nutrient management showed significant effect on energy pondered by weeds. Among nutrient management, minimum energy was pondered by weeds in 100% RDF at all intervals during both the years as well as on mean data basis.

Among weed management practices, at 45 DAS imazethapyr 50 g ha^{-1} as PE fb metribuzin 0.3 kg ha^{-1} as PoE showed minimum energy. At harvest minimum energy was pondered by weeds in pre-emergence application of metribuzin 0.4 kg ha^{-1} + oxyfluorfen 0.3 kg ha^{-1}.



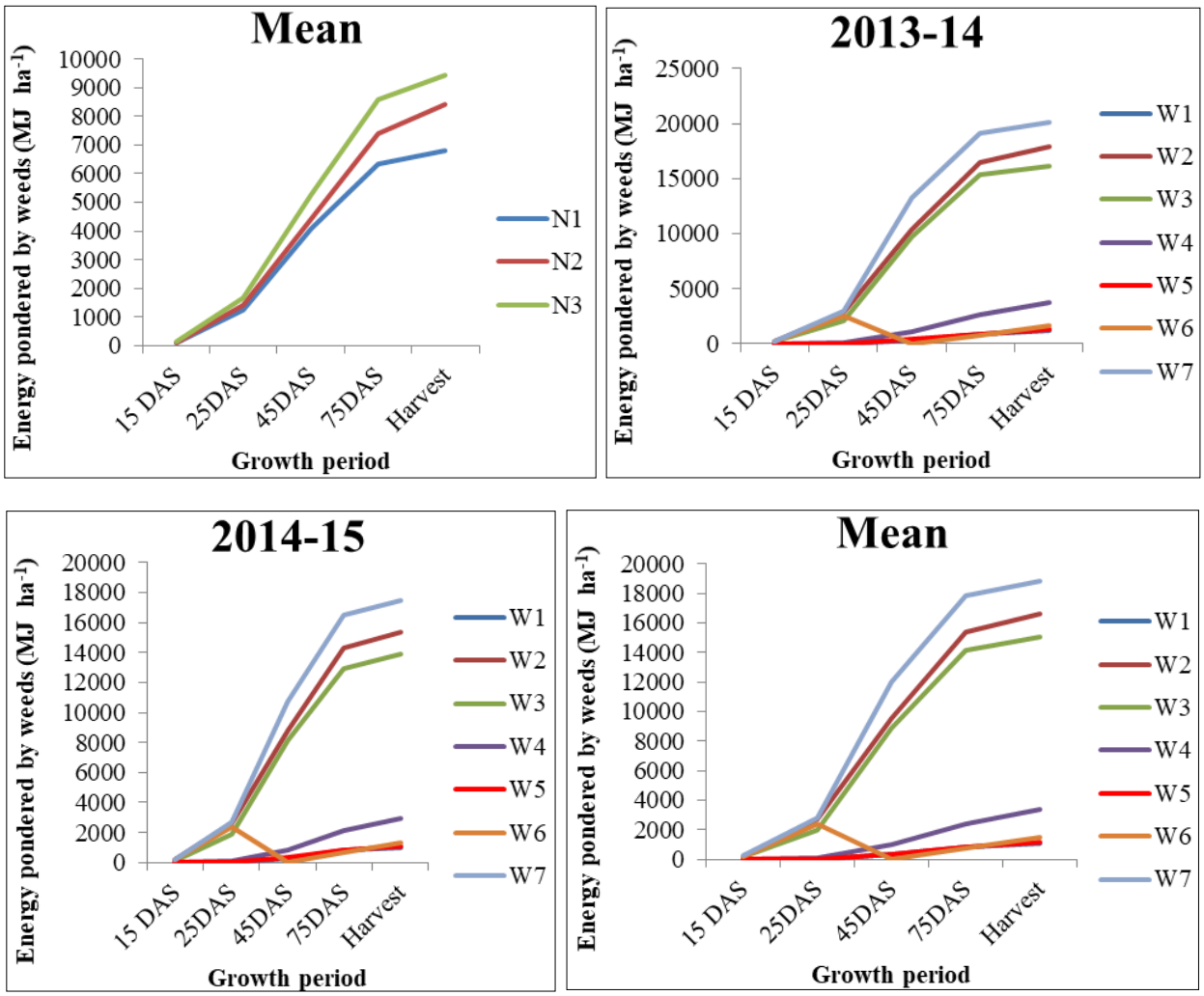


Fig 2: Energy pondered by weeds at harvest as influenced by irrigation levels and weed management practices

Discussion

The total weed density, dry matter of weeds were significantly influenced due to nutrient management practices. 125% RDF and 150% RDF were comparable to each other and was significantly higher than that of under 100% RDF. The higher weed density and weed dry matter under 125% RDF and 150% RDF was due to the fact that under 125% RDF and 150% RDF there might be more availability of nutrients which allow weeds to germinate and their growth. Higher weed population and dry matter production of weeds were observed under high dose of nutrients. The weed dry matter production was significantly the highest in untreated control which was due to absence of suitable weed management practices. In variance, the significant lower weed density and weed dry matter were observed under pre-emergence application of metribuzin 0.4 kg ha^{-1} + oxyfluorfen 0.3 kg ha^{-1}, oxyfluorfen 0.3 kg ha^{-1} as PE fb imazethapyr 50 g ha^{-1} as PoE and imazethapyr 50 gha^{-1} as PE fb metribuzin 0.3 $kgha^{-1}$ as PoE at 45 DAS But at later period *i.e.* at harvest pre-emergence application of metribuzin 0.4 kg ha^{-1} + oxyfluorfen 0.3 kg ha^{-1}proved to be the best in minimizing density and dry matter of weeds. Similar trend was also observed in case of weed growth rate, weed index and energy pondered by weeds. Pre-emergence application of metribuzin 0.4 kg ha^{-1} + oxyfluorfen 0.3 kg ha^{-1},oxyfluorfen 0.3 kg ha^{-1} showed the maximum weed control efficiency throughout the growth period of chickpea and it was followed by oxyfluorfen 0.3 kg ha^{-1} as PE fb imazethapyr 50 g ha^{-1} as PoE. The minimum density and dry matter of weeds, weed growth rate, energy pondered by weeds and the maximum weed control efficiency under pre-emergence application of metribuzin 0.4 kg ha^{-1} + oxyfluorfen 0.3 kg $ha^{-1}$was due to effective control of weeds in terms of density as well as their dry matter particularly *Medicago denticulata*, *Melilotus indica and Chenopodium album* starting from germination to harvest of chickpea. The weed growth rate, energy pondered by weeds and weed index are directly related to the dry matter of weeds. Since, there was minimum dry matter of weeds under pre-emergence application of metribuzin 0.4 kg ha^{-1} + oxyfluorfen 0.3 kg ha^{-1}, all the parameters were the minimum and weed control efficiency was the maximum. Singh and Bhan (1999) [6] reported that metribuzin @ 0.75 and 1.0 kg ha^{-1} has markedly lowered weed density and weed dry weight than weedy check. Weed index indicate the reduction in yield due to weed competition as compare to the maximum attained seed yield. The maximum weed index under untreated control was due to the fact, there was minimum seed yield. Maximum weed control efficiency might be due to owing to less weed density and production of dry matter by weeds in the treated plots.

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