

Original Research Article

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Role of Allelopathic Weed Management on Nutrient Uptake in Pigeonpea (*Cajanus cajan* L.)

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ABSTRACT

A pot experiment was carried out at Zonal Agriculture Research Station, Kalaburagi (Karnataka), during *kharif* 2018 and 2019 to study the role of allelopathic weed management on nutrient uptake in pigeonpea (*Cajanus cajan* L.). The soil was medium deep black with soil pH (8.13), EC (0.25 dS m⁻¹), available nitrogen (242 kg ha⁻¹), P₂O₅ (34 kg ha⁻¹) and K₂O (347 kg ha⁻¹). The experiment was laid out in completely randomised block design which comprised of 18 treatments with three replications, consisting four plant extracts, *i.e.*, Sorghum, Parthenium, Cassia and Eucalyptus and imazythapyre herbicide. All the practices followed were according to package of practice of UAS, Raichur. The data of each crop season were statistically analyzed. Weed management practices significantly influenced the grain yield and nutrient uptake (N, P and K). Among all the treatments; Imazythapyre @ 56.25 g *a.i./ha* + sorghum plant extract at 20-25 DAS, imazythapyre @ 56.25 g *a.i./ha* + cassia plant extract at 20-25 DAS, imazythapyre @ 56.25 g *a.i./ha* + parthenium plant extract at 20-25 DAS, imazythapyre @ 37.5 g *a.i./ha* + sorghum plant extract at 20-25 DAS, imazythapyre @ 56.25 g *a.i./ha* + eucalyptus leaf extract at 20-25 DAS, imazythapyre @ 37.5 g *a.i./ha* + cassia plant extract at 20-25 DAS, imazythapyre @ 37.5 g *a.i./ha* + parthenium plant extract at 20-25 DAS and imazythapyre @ 37.5 g *a.i./ha* + eucalyptus leaf extract at 20-25 DAS recorded significantly higher grain yield and uptake of nitrogen, phosphorus and potassium compared to rest of the treatments. Plant extracts when used with herbicide help to reduce usage of herbicide by 50 % by avoiding ill effects on soil fertility and productivity can be maintained for longer period.

Keywords

Allelopathy,
Nutrient uptake,
Grain yield

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Introduction

Pulses are an important component of agricultural food crops and the cheapest source of dietary protein. The high content of

protein in pulses makes the diet more nutritive for vegetarian when consumed with other cooked food items. Pulses are rich source of protein, dietary fiber, complex carbohydrates and K, Se, Fe and Zn-power house of

nutrients. Pulses are also known for increasing productivity of soil through fixation of nitrogen from atmosphere. Pulses are well suited in rainfed condition and require less farm resources; hence farmers prefer to grow them from economic point of view throughout the country that helps to eliminate hunger, food security and malnutrition. India plays a key role in global pulse production and contributes about 25 per cent to the total pulse basket with total production of 3.38 million tonnes from 4.55 million ha area (Anon., 2019). On account of their value as nutritious food, feed and forage, pulses remained an integral component of subsistence cropping system since time immemorial. Weed is one of the important limiting factor in pigeonpea production through competition for environmental resource and can reduce yield by 30-45 % (Talnikar *et al.*, 2008). Today, the most of pigeonpea producers use chemical herbicides for weed control in pigeonpea, Application of high dose of chemical herbicide in agricultural production causes many adverse effects that most of them relating to incorrect use of herbicide. One of the adverse effect of herbicides application is evolution of resistant weed biotypes.

The major challenge for India is that of producing adequate food for the ever growing human population. Traditional method of pigeonpea cultivation is no longer a viable system of crop production because of increasing human population on limited arable land, which has reduced the duration of fallow, low soil fertility, declining crop yield and high weed pressure are some of the problems that have been associated with reduced fallow duration and intensification of cropping systems. Pigeonpea being long duration crop, cultivated with wider spacing due to which weed management in these rows plays significant role on yield of the crop. These weeds can cause 20-90 % yield loss in

pulse crops (Pooniya *et al.*, 2015). Management of weeds by using herbicide is the commonly followed method. Recent advances in management of weeds through plant water extracts *i.e.*, allelopathy is gaining importance due to better control of weeds, cost effective and biodegradability.

Materials and Methods

A pot experiment was carried out at Zonal Agriculture Research Station, Kalaburagi (Karnataka), during *kharif* 2018 and 2019; the study was conducted to study the role of allelopathic weed management on nutrient uptake in pigeonpea (*Cajanus cajan* L.). The soil was medium deep black with soil pH (8.13), EC (0.25 dS m⁻¹), available nitrogen (242 kg ha⁻¹), P₂O₅ (34 kg ha⁻¹) and K₂O (347 kg ha⁻¹). The experiment was laid out in completely randomised block design which comprised of 18 treatments in three replications, consisting four plant extracts, *i.e.*, Sorghum, Parthenium, Cassia and Eucalyptus and imazythapyre herbicide. All the practices followed were according to package of practice of UAS, Raichur. Treatments as follows; T₁:: Imazythapyre @ 18.75 g *a.i./ha* + Sorghum plant extract at 20-25 DAS, T₂:: Imazythapyre @ 37.5 g *a.i./ha* + Sorghum plant extract at 20-25 DAS, T₃:: Imazythapyre: @ 56.25 g *a.i./ha* + Sorghum plant extract at 20-25 DAS, T₄:: Only Sorghum plant extract at 20-25 DAS, T₅:: Imazythapyre @ 18.75 g *a.i./ha* + Parthenium plant extract at 20-25 DAS, T₆:: Imazythapyre @ 37.5 g *a.i./ha* + Parthenium plant extract at 20-25 DAS, T₇:: Imazythapyre: @ 56.25 g *a.i./ha* + Parthenium plant extract at 20-25 DAS, T₈:: Only Parthenium plant extract at 20-25 DAS, T₉:: Imazythapyre @ 18.75 g *a.i./ha* + Eucalyptus: leaf extract at 20-25 DAS, T₁₀:: Imazythapyre @ 37.5 g *a.i./ha* + Eucalyptus leaf extract at 20-25 DAS, T₁₁:: Imazythapyre @ 56.25 g *a.i./ha* + Eucalyptus leaf extract at 20-25 DAS, T₁₂:: Only

Eucalyptus leaf extract at 20-25 DAS, T₁₃:: Imazythapyre @ 18.75 g *a.i./ha* + Cassia plant extract at 20-25 DAS, T₁₄:: Imazythapyre @ 37.5 g *a.i./ha* + Cassia plant extract at 20-25 DAS, T₁₅:: Imazythapyre @ 56.25 g *a.i./ha* + Cassia plant extract at 20-25 DAS, T₁₆:: Only Cassia plant extract at 20-25 DAS, T₁₇:: Weed free and T₁₈:: Unweeded check were used in the experiment.

Recommended dose of N, P and K (25:50:00 kg N, P₂O₅ K₂O ha⁻¹) were applied to the soil in the form of urea, di-ammonium phosphate and muriate of potash at the time of sowing and subsequent applications were done by following package of practice. At each spot two seeds were dibbled up to 4 to 5 cm deep in the seed lines.

The pigeonpea variety, TS-3R was used during both the years and was sown at spacing of 90 x 30 cm. All agronomical packages of practices were followed to raise the crop. Nitrogen, phosphorus and potassium content in composite plant sample of pigeonpea at harvest was estimated by modified micro-kjeldhal method, vanadomolybdate yellow colour method and flame photometer method, respectively as outlined by (Jackson, 1973).

$$\text{Uptake of nutrient (kg per ha)} = \frac{\text{Nutrient concentration (\%)} \times \text{Biomass (kg per ha)}}{100}$$

The data of each crop season were statistically analyzed. Fisher's method of analysis of variance was applied for analysis and interpretation of the data as given by Panse and Sukhatme, 1967.

The level of significance used in 'F' test was at p = 0.05. Critical difference values were calculated whenever 'F' was significant. In other cases, values of standard error of means have been provided.

Results and Discussion

Grain yield (kg ha⁻¹)

Grain yield as influenced by allelopathic effect of plant extracts as weed management practice in pigeonpea is presented in the Table 1 and is clear that it varied significantly in different treatments. Significantly higher grain yield was seen in weed free treatment (2336 kg ha⁻¹) and was on par with imazythapyre @ 56.25 g *a.i./ha* + sorghum plant extract at 20-25 DAS (2175 kg ha⁻¹), imazythapyre @ 56.25 g *a.i./ha* + cassia plant extract at 20-25 DAS (2054 kg ha⁻¹), imazythapyre @ 56.25 g *a.i./ha* + parthenium plant extract at 20-25 DAS (2014 kg ha⁻¹), imazythapyre @ 37.5 g *a.i./ha* + sorghum plant extract at 20-25 DAS (1998 kg ha⁻¹), imazythapyre @ 56.25 g *a.i./ha* + eucalyptus leaf extract at 20-25 DAS (1981 kg ha⁻¹), imazythapyre @ 37.5 g *a.i./ha* + cassia plant extract at 20-25 DAS (1968 kg ha⁻¹), imazythapyre @ 37.5 g *a.i./ha* + parthenium plant extract at 20-25 DAS (1954 kg ha⁻¹) and imazythapyre @ 37.5 g *a.i./ha* + eucalyptus leaf extract at 20-25 DAS (1933 kg ha⁻¹) and significantly lower grain yield was seen (964 kg ha⁻¹) in unweeded check in pooled data.

Extracts and residues of tested species might have the potential to be used for pre-emergence and post-emergence weed control (Neknam *et al.*, 2013). Application of reduced dose of herbicides mixed with allelopathic water extracts produced higher grain yield compared with the application of reduced dose of herbicides (Khan and Khan, 2012).

Gilbert *et al.*, (1999) reported that allelochemical facilitate nutrient solubilization and release nutrients from complex forms. Under low phosphorus (P) levels, plant release phosphatases which improve P availability through hydrolysis.

Phenolics improve release and uptake of P, Iron (Fe) and other nutrients under their less availability. The basic function is the

solubilization of nutrients. They make nutrients more mobile and thus improve their uptake in plant body.

Table.1 Grain yield (kg ha⁻¹) as influenced by weed management in pigeonpea by allelopathy in pot culture experiment

Treatment	Grain yield (kg ha ⁻¹)		
	2018	2019	Pooled
T ₁ : Imazythapyre @ 18.75 g a.i./ha + Sorghum plant extract at 20-25 DAS	1529	1752	1641
T ₂ : Imazythapyre @ 37.5 g a.i./ha + Sorghum plant extract at 20-25 DAS	1869	2126	1998
T ₃ : Imazythapyre @ 56.25 g a.i./ha + Sorghum plant extract at 20-25 DAS	2054	2296	2175
T ₄ : Only Sorghum plant extract at 20-25 DAS	1005	1407	1206
T ₅ : Imazythapyre @ 18.75 g a.i./ha + Parthenium plant extract at 20-25 DAS	1355	1703	1529
T ₆ : Imazythapyre @ 37.5 g a.i./ha + Parthenium plant extract at 20-25 DAS	1827	2081	1954
T ₇ : Imazythapyre @ 56.25 g a.i./ha + Parthenium plant extract at 20-25 DAS	1879	2148	2014
T ₈ : Only Parthenium plant extract at 20-25 DAS	918	1333	1126
T ₉ : Imazythapyre @ 18.75 g a.i./ha + Eucalyptus leaf extract at 20-25 DAS	1311	1666	1489
T ₁₀ : Imazythapyre @ 37.5 g a.i./ha + Eucalyptus leaf extract at 20-25 DAS	1792	2074	1933
T ₁₁ : Imazythapyre @ 56.25 g a.i./ha + Eucalyptus leaf extract at 20-25 DAS	1850	2111	1981
T ₁₂ : Only Eucalyptus leaf extract at 20-25 DAS	1005	1400	1203
T ₁₃ : Imazythapyre @ 18.75 g a.i./ha + Cassia plant extract at 20-25 DAS	1398	1740	1569
T ₁₄ : Imazythapyre @ 37.5 g a.i./ha + Cassia plant extract at 20-25 DAS	1835	2100	1968
T ₁₅ : Imazythapyre @ 56.25 g a.i./ha + Cassia plant extract at 20-25 DAS	1923	2185	2054
T ₁₆ : Only Cassia plant extract at 20-25 DAS	961	1370	1166
T ₁₇ : Weed free	2228	2444	2336
T ₁₈ : Unweeded check	743	1185	964
S.Em±	129	150	111
C.D. at 5 %	494	577	428

Table.2 Nitrogen (kg ha^{-1}) uptake as influenced by weed management in pigeonpea by allelopathy in pot culture experiment

Treatment	Nitrogen (kg ha^{-1})		
	2018	2019	Pooled
T₁ : Imazythapyre @ 18.75 g a.i./ha + Sorghum plant extract at 20-25 DAS	94.28	98.99	96.64
T₂ : Imazythapyre @ 37.5 g a.i./ha + Sorghum plant extract at 20-25 DAS	99.48	104.42	101.95
T₃ : Imazythapyre @ 56.25 g a.i./ha + Sorghum plant extract at 20-25 DAS	107.21	112.59	109.90
T₄ : Only Sorghum plant extract at 20-25 DAS	89.21	93.69	91.45
T₅ : Imazythapyre @ 18.75 g a.i./ha + Parthenium plant extract at 20-25 DAS	92.10	96.70	94.40
T₆ : Imazythapyre @ 37.5 g a.i./ha + Parthenium plant extract at 20-25 DAS	97.10	101.99	99.54
T₇ : Imazythapyre @ 56.25 g a.i./ha + Parthenium plant extract at 20-25 DAS	100.15	105.19	102.67
T₈ : Only Parthenium plant extract at 20-25 DAS	87.80	92.19	90.00
T₉ : Imazythapyre @ 18.75 g a.i./ha + Eucalyptus leaf extract at 20-25 DAS	91.35	95.91	93.63
T₁₀ : Imazythapyre @ 37.5 g a.i./ha + Eucalyptus leaf extract at 20-25 DAS	96.30	101.12	98.71
T₁₁ : Imazythapyre @ 56.25 g a.i./ha + Eucalyptus leaf extract at 20-25 DAS	98.12	103.03	100.57
T₁₂ : Only Eucalyptus leaf extract at 20-25 DAS	89.10	93.56	91.33
T₁₃ : Imazythapyre @ 18.75 g a.i./ha + Cassia plant extract at 20-25 DAS	93.55	98.23	95.89
T₁₄ : Imazythapyre @ 37.5 g a.i./ha + Cassia plant extract at 20-25 DAS	97.95	102.85	100.40
T₁₅ : Imazythapyre @ 56.25 g a.i./ha + Cassia plant extract at 20-25 DAS	101.33	106.40	103.86
T₁₆ : Only Cassia plant extract at 20-25 DAS	88.50	92.93	90.71
T₁₇ : Weed free	109.20	114.69	111.94
T₁₈ : Unweeded check	85.11	89.37	87.24
S.Em±	3.62	3.85	3.64
C.D. at 5 %	13.93	14.79	14.01

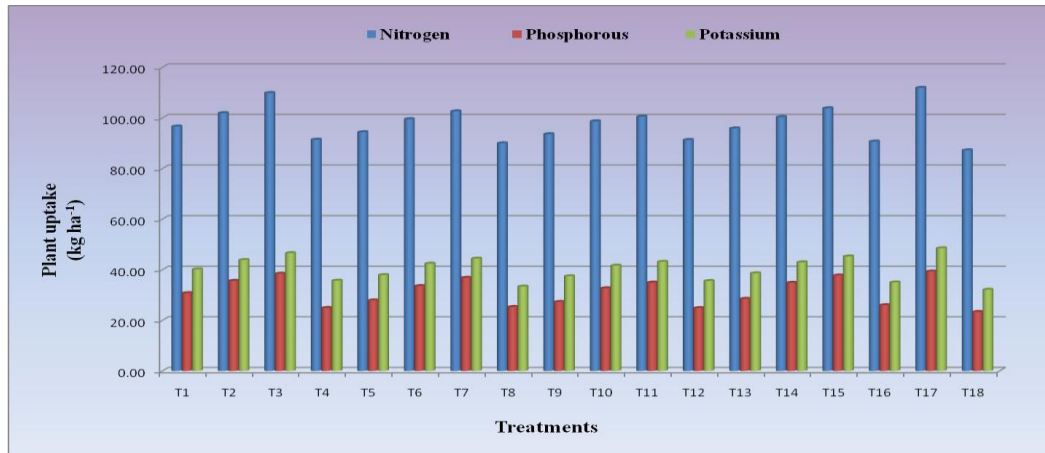
Table.3 Phosphorous (kg ha⁻¹) uptake as influenced by weed management in pigeonpea by allelopathy in pot culture experiment

Treatment	Phosphorous (kg ha ⁻¹)		
	2018	2019	Pooled
T₁ : Imazythapyre @ 18.75 g a.i./ha + Sorghum plant extract at 20-25 DAS	29.45	32.10	30.78
T₂ : Imazythapyre @ 37.5 g a.i./ha + Sorghum plant extract at 20-25 DAS	34.10	37.17	35.63
T₃ : Imazythapyre @ 56.25 g a.i./ha + Sorghum plant extract at 20-25 DAS	36.80	40.11	38.46
T₄ : Only Sorghum plant extract at 20-25 DAS	23.85	26.00	24.92
T₅ : Imazythapyre @ 18.75 g a.i./ha + Parthenium plant extract at 20-25 DAS	26.70	29.10	27.90
T₆ : Imazythapyre @ 37.5 g a.i./ha + Parthenium plant extract at 20-25 DAS	32.13	35.02	33.58
T₇ : Imazythapyre @ 56.25 g a.i./ha + Parthenium plant extract at 20-25 DAS	35.25	38.42	36.84
T₈ : Only Parthenium plant extract at 20-25 DAS	24.22	26.40	25.31
T₉ : Imazythapyre @ 18.75 g a.i./ha + Eucalyptus leaf extract at 20-25 DAS	26.11	28.46	27.28
T₁₀ : Imazythapyre @ 37.5 g a.i./ha + Eucalyptus leaf extract at 20-25 DAS	31.30	34.12	32.71
T₁₁ : Imazythapyre @ 56.25 g a.i./ha + Eucalyptus leaf extract at 20-25 DAS	33.45	36.46	34.96
T₁₂ : Only Eucalyptus leaf extract at 20-25 DAS	23.80	25.94	24.87
T₁₃ : Imazythapyre @ 18.75 g a.i./ha + Cassia plant extract at 20-25 DAS	27.30	29.76	28.53
T₁₄ : Imazythapyre @ 37.5 g a.i./ha + Cassia plant extract at 20-25 DAS	33.38	36.38	34.88
T₁₅ : Imazythapyre @ 56.25 g a.i./ha + Cassia plant extract at 20-25 DAS	36.12	39.37	37.75
T₁₆ : Only Cassia plant extract at 20-25 DAS	24.90	27.14	26.02
T₁₇ : Weed free	37.65	41.01	39.33
T₁₈ : Unweeded check	22.35	24.36	23.36
S.Em±	1.73	1.90	1.81
C.D. at 5 %	6.66	7.29	6.94

Table.4 Potassium (kg ha^{-1}) uptake as influenced by weed management in pigeonpea by allelopathy in pot culture experiment

Treatment	Potassium (kg ha^{-1})		
	2018	2019	Pooled
T₁ : Imazythapyre @ 18.75 g a.i./ha + Sorghum plant extract at 20-25 DAS	38.65	41.74	40.20
T₂ : Imazythapyre @ 37.5 g a.i./ha + Sorghum plant extract at 20-25 DAS	42.16	45.53	43.85
T₃ : Imazythapyre @ 56.25 g a.i./ha + Sorghum plant extract at 20-25 DAS	44.80	48.38	46.59
T₄ : Only Sorghum plant extract at 20-25 DAS	34.33	37.08	35.70
T₅ : Imazythapyre @ 18.75 g a.i./ha + Parthenium plant extract at 20-25 DAS	36.45	39.37	37.91
T₆ : Imazythapyre @ 37.5 g a.i./ha + Parthenium plant extract at 20-25 DAS	40.82	44.09	42.45
T₇ : Imazythapyre @ 56.25 g a.i./ha + Parthenium plant extract at 20-25 DAS	42.72	46.14	44.43
T₈ : Only Parthenium plant extract at 20-25 DAS	32.10	34.67	33.38
T₉ : Imazythapyre @ 18.75 g a.i./ha + Eucalyptus leaf extract at 20-25 DAS	36.02	38.90	37.46
T₁₀ : Imazythapyre @ 37.5 g a.i./ha + Eucalyptus leaf extract at 20-25 DAS	40.06	43.26	41.66
T₁₁ : Imazythapyre @ 56.25 g a.i./ha + Eucalyptus leaf extract at 20-25 DAS	41.50	44.82	43.16
T₁₂ : Only Eucalyptus leaf extract at 20-25 DAS	34.21	36.95	35.58
T₁₃ : Imazythapyre @ 18.75 g a.i./ha + Cassia plant extract at 20-25 DAS	37.12	40.09	38.60
T₁₄ : Imazythapyre @ 37.5 g a.i./ha + Cassia plant extract at 20-25 DAS	41.32	44.63	42.97
T₁₅ : Imazythapyre @ 56.25 g a.i./ha + Cassia plant extract at 20-25 DAS	43.55	47.03	45.29
T₁₆ : Only Cassia plant extract at 20-25 DAS	33.65	36.34	35.00
T₁₇ : Weed free	46.65	50.38	48.52
T₁₈ : Unweeded check	30.90	33.37	32.14
S.Em±	1.82	2.16	1.93
C.D. at 5 %	6.98	8.32	7.41

Fig.1 Nutrients uptake (kg ha^{-1}) by pigeonpea crop as influenced by weed management in pigeonpea by allelopathy in pot culture experiment



Nitrogen uptake (kg ha^{-1})

Nitrogen uptake data as influenced by allelopathic effect of plant extracts as weed management practice in pigeonpea is presented in Table 2 and Fig. 1 and it varied significantly among different weed management practices. Significantly higher nitrogen uptake was noted in weed free treatment ($111.94 \text{ kg ha}^{-1}$) in pooled data and other treatments like; imazythapyre @ 56.25 g a.i./ha + sorghum plant extract at 20-25 DAS ($109.90 \text{ kg ha}^{-1}$), imazythapyre @ 56.25 g a.i./ha + cassia plant extract at 20-25 DAS ($103.86 \text{ kg ha}^{-1}$), imazythapyre @ 56.25 g a.i./ha + parthenium plant extract at 20-25 DAS ($102.67 \text{ kg ha}^{-1}$), imazythapyre @ 37.5 g a.i./ha + sorghum plant extract at 20-25 DAS ($101.95 \text{ kg ha}^{-1}$), imazythapyre @ 56.25 g a.i./ha + eucalyptus leaf extract at 20-25 DAS ($100.57 \text{ kg ha}^{-1}$), imazythapyre @ 37.5 g a.i./ha + cassia plant extract at 20-25 DAS ($100.40 \text{ kg ha}^{-1}$), imazythapyre @ 37.5 g a.i./ha + parthenium plant extract at 20-25 DAS (99.54 kg ha^{-1}) and imazythapyre @ 37.5 g a.i./ha + eucalyptus leaf extract at 20-25 DAS (98.71 kg ha^{-1}) were on par with it and significantly lower nitrogen uptake was seen (87.24 kg ha^{-1}) in unweeded check.

Phosphorous uptake (kg ha^{-1})

The data pertaining to phosphorous uptake as influenced by plant extracts as weed management practice in pigeonpea by allelopathy is presented (Table 3 and Fig. 1) and it varied significantly among different weed management practices. The treatments; imazythapyre @ 56.25 g a.i./ha + sorghum plant extract at 20-25 DAS (38.46 kg ha^{-1}), imazythapyre @ 56.25 g a.i./ha + cassia plant extract at 20-25 DAS (37.75 kg ha^{-1}), imazythapyre @ 56.25 g a.i./ha + parthenium plant extract at 20-25 DAS (36.84 kg ha^{-1}), imazythapyre @ 37.5 g a.i./ha + sorghum plant extract at 20-25 DAS (35.63 kg ha^{-1}), imazythapyre @ 56.25 g a.i./ha + eucalyptus leaf extract at 20-25 DAS (34.96 kg ha^{-1}), imazythapyre @ 37.5 g a.i./ha + cassia plant extract at 20-25 DAS (34.88 kg ha^{-1}), imazythapyre @ 37.5 g a.i./ha + parthenium plant extract at 20-25 DAS (33.5 kg ha^{-1}) and imazythapyre @ 37.5 g a.i./ha + eucalyptus leaf extract at 20-25 DAS (32.71 kg ha^{-1}) were on par with weed free treatment (39.33 kg ha^{-1}) that remarked significantly higher phosphorous uptake and unweeded check recorded significantly lower phosphorous uptake (23.36 kg ha^{-1}).

Potassium uptake (kg ha^{-1})

The potassium uptake data was influenced by plant extracts as weed management practice in pigeonpea by allelopathy and showed that it varied significantly among different weed management practices (Table 4 and Fig. 1). Weed free treatment noted significantly higher potassium uptake (48.52 Kg ha^{-1}) in both the years and in pooled data. Whereas, imazythapyre @ 56.25 g a.i./ha + sorghum plant extract at 20-25 DAS (46.59 kg ha^{-1}), imazythapyre @ 56.25 g a.i./ha + cassia plant extract at 20-25 DAS (45.29 kg ha^{-1}), imazythapyre @ 56.25 g a.i./ha + parthenium plant extract at 20-25 DAS (44.43 kg ha^{-1}), imazythapyre @ 37.5 g a.i./ha + sorghum plant extract at 20-25 DAS (43.85 kg ha^{-1}), imazythapyre @ 56.25 g a.i./ha + eucalyptus leaf extract at 20-25 DAS (43.16 kg ha^{-1}), imazythapyre @ 37.5 g a.i./ha + cassia plant extract at 20-25 DAS (42.97 kg ha^{-1}), imazythapyre @ 37.5 g a.i./ha + parthenium plant extract at 20-25 DAS (42.45 kg ha^{-1}) and imazythapyre @ 37.5 g a.i./ha + eucalyptus leaf extract at 20-25 DAS (41.66 kg ha^{-1}) were on par with it and unweeded check recorded significantly lower potassium uptake (32.14 kg ha^{-1}).

Weed management practices significantly influenced the nutrient uptake by crop plants (N, P and K) among all the treatments after harvest of pigeonpea. Imazythapyre @ 56.25 g a.i./ha + sorghum plant extract at 20-25 DAS, imazythapyre @ 56.25 g a.i./ha + cassia plant extract at 20-25 DAS, imazythapyre @ 56.25 g a.i./ha + parthenium plant extract at 20-25 DAS, imazythapyre @ 37.5 g a.i./ha + sorghum plant extract at 20-25 DAS, imazythapyre @ 56.25 g a.i./ha + eucalyptus leaf extract at 20-25 DAS, imazythapyre @ 37.5 g a.i./ha + cassia plant extract at 20-25 DAS, imazythapyre @ 37.5 g a.i./ha + parthenium plant extract at 20-25 DAS and imazythapyre @ 37.5 g a.i./ha + eucalyptus

leaf extract at 20-25 DAS recorded significantly higher uptake of nitrogen, phosphorus and potassium compared to rest of the treatments which might be due to higher biomass in these treatments and therefore higher uptake of nutrients observed.

Allelochemicals have been reported to decrease uptake of mineral elements by altering the functions of plasma membranes in plant roots, depolarizing the electrochemical potential gradient across membranes; a primary driving force for ion uptake and decreasing ATP content of cells by inhibiting electron transport and oxidative phosphorylation and by changing the permeability of membranes to mineral ions (Balke 1985). Ferulic acid is an allelochemical found in many plants such as sorghum and rice which is also exuded into soil by these plants. Booker *et al.*, (1992) used intact cucumber (*Cucumis sativus*) seedlings to evaluate the effect of ferulic acid on mineral uptake and water relations of cucumber and observed that ferulic acid inhibited mineral uptake, especially N and also reduced leaf: turgor pressure and water potential.

Allelochemicals, upon release into the rhizosphere may influence nutrient movement, availability and uptake by plants. Changes in microbial activities and nutrient dynamics on addition of allelochemicals to the soil have been reported (Karmarkar and Tabatabai 1991). Usually, allelochemicals are first perceived by the receiver plant's roots which may then affect nutrient uptake and these compounds may restrict or improve the nutrients mobility to plants (Yu and Matsui 1997). Dalipu (2001) studied the effect of different weed species on leaf total chlorophyll content and leaf nitrate reductase (NR) activity of rice plant.: They reported that both the weeds *Cynadon dactylon* and *Cyperus rotundus* at low concentration (1:20)

increased the total chlorophyll content, nitrate reductase (NR) activity of rice plant, uptake of N, P, K at harvest and soil available N, P and K were low at 25 and 50 DAS, it might be due to growth promotion property of allelopathic water extracts of these weeds at low concentration.

Sorghum, Parthenium, Cassia and Eucalyptus plant extracts with imazythapyre herbicide at 50 % and 75 % help to get good control of weeds in pigeonpea. Thereby help to improve the growth of pigeonpea indirectly by good uptake of the available nutrients in the soil, less competition for the resources from weeds and through releasing allelochemicals directly into crop rhizosphere that help to mineralize the unavailable form of nutrient and improve the growth of the crop directly. Even the use of these plant extracts is cost effective which reduces the burden of farmers with respect to herbicides. Hence plant extracts can be used with herbicide which will help to reduce the usage of herbicide by 50 % and dependency on herbicides can be reduced, through which ill effects of herbicides on soil can be avoided, soil fertility can be maintained for longer period and this helps improve the crop growth.

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