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Research Paper

Effect of crop residue and weed management on weed incidence, soil moisture and yield of chickpea

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ABSTRACT

Chickpea is a major pulse crop which is grown and consumed by the Indian people. Due to poor weed competition ability of chickpea and very few weed management options, yield of chickpea is drastically reduced under vertisols. Therefore, the present study related to weed management and crop residues on weed incidence, yield attributing character and yield of chickpea was conducted at Research Farm of JNKVV, Jabalpur (MP), India. A field experiment was undertaken in split plot design with 3 replications and 4 weed-management treatment in main-plot and four crop residues as sub-plot. The main plot treatments were pendimethalin 38.7% CS at 1 kg/ha as pre plant incorporation (PPI), hand weeding at 30 days after sowing (DAS), hand hoeing at 30 DAS and weedy check. Four crop residues mulch (CRM) were, wheat straw (WSM), paddy straw (PSM) and soybean haulm (SHM) each at 5 t/ha and control where no mulch material was applied. Results revealed that imposition of hand weeding at 30 DAS recorded with least weeds with lesser weed biomass resulting in higher weed control efficiency (WCE). However, weedy check recorded maximum weed count and dry weight. Pendimethalin 1 kg/ha recorded lower weed prevalence and weed dry weight. It was similar to hand hoeing done at 30 DAS. Among applied CRM, PSM recorded lower weed density and dry weight with higher WCE and soil moisture at 30 DAS and was superior over control plots. Hand weeding at 30 DAS recorded with higher yield attributing traits *viz,* pods/plant, seed/pod and seed index resulted higher seed yield (1,604 and 1,731 kg/ha respectively in 2018–19 and 2019–20). It was at par with pendimethalin at 1 kg/ha. The lower yield attributes and yield was recorded in weedy check plots. Among CRM, spreading of PSM give more pods and seeds/pod with higher seed index resulted in higher seed yield (1515 and 1593 kg/ha in 2018–19 and 2019–20 respectively) over others. Thus, application of PSM at 5 t/ha with one hand weeding at 30 DAS or with pendimethalin can be suggested for significant weed control and higher seed yield in chickpea.

Key Words: Hand weeding, Mulch, Pendimethalin, Soil moisture, Yield

India is the largest Chickpea (*Cicer arietinum* L.) grower and consumer in the world with area, production and productivity of 9.44 Mha and 10.13 MT and 10.73 ka/ha respectively. Among the states Madhya Pradesh is first in area, production and productivity of 3.34 Mha, 4.41 MT and 1344 kg/ha respectively (Directorate of Economics and Statistics, 2019). The availability of food grains increased from 144.1 kg/year in 1951 to 179.6 kg/year during 2019. Increasing in the nation's population per capita availability of pulses has been reduced from 25 kg/year to 17.5 kg/year in 2019 (Anonymous, 2020). Legume crops are the main source of protein in the diet of Indian people. Rhizobium take the food material from chickpea and provide atmospheric nitrogen to plant in available from causes behind this it take lesser nitrogen from the soil (Havlin *et al.,* 2014). Weeds are drastically yield reducer in chickpea under irrigated condition, it reduces yield of chickpea by more than 70% when no weed control measures were adopted (Sahu *et al.,* 2022). During, rabi season, broadleaf weeds are major yield reducer as compared with grassy weeds (Baghel, 2018). The weeds in irrigated situations tend to offer severe competition for growth resources and cause drastic yield reduction to the extent of 75 per cent (Balyan and Bhan, 1984; Singh and Singh, 1992). Chickpea suffers a lot from broad leaved weeds as compared to grassy weeds (Baghel, 2018). Among the broad

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leaved weeds, *Chenopodium album, Melilotus alba, Melilotus indica, Vicia sativa, Lathyrus aphaca,* and *Anagallis arvensis* etc. mostly affect the chickpea crop at Jabalpur (Sahu *et al*., 2022 and Chauhan *et al.,* 2017). In chickpea weed control measures done by mechanical, cultural and chemical methods. Mechanical methods *viz.*, hand weeding and hand hoeing are mostly adopted for control of weeds but these are time and labour consuming methods. On the other hand, herbicides provide effective weed control and found more economical but cause negative impacts on environment and human health. Mulches are an effective non-chemical material for weed suppression, which is a cultural method for weed management (Mahmood *et al.,* 2015). Crop residues are available in huge quantity in the field as crops are harvested by combines and forcing the farmer to go burning. It is therefore, necessary to make judicious use of left out crop residues in the field in the form of mulch. When mulch is placed on or spread over the soil surface, it protect the soil from erosion, conserve soil moisture and suppress weed growth. Beside this, helps in proper growth and development of crop plants by modifying soil temperature, providing better nutrient and soil moisture availability (Sarangi *et al*., 2021). In addition to this, the crop mulches release allelopathic chemicals like hydroxamic and phenolic acids, and effectively reduce herbicide use in order to maintain an eco-friendly environment and a cost-effective weed control (Lam *et al.,* 2012). Hence, there is need to adjudge the suitable combination of herbicides with straw mulches to curb the dry matter production of weeds and find out eco-friendly weed control measure in chickpea (Nosrati *et al.,* 2017). Since knowledge about efficacy of pendimethalin 38.7% CS as pre-plant incorporation (PPI) alone and in combination with crop mulch is very few, therefore present experiment was conducted to judge the suitable weed control practices and straw mulches on weed growth, yield attributing traits and yield of chickpea.

MATERIALS AND METHODS

A two year field experiment was carried out during *Rabi* 2018-19 and 2019-20 at Live Stock Farm, Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur situated at 23.18^0 N latitude 79.99^0 E longitude and an altitude 412 Metre above the mean sea level. Soil of experimental area was sandy loam in texture, neutral in reaction (pH 7.24) having medium organic carbon (0.61 %) and available N (365.20 kg/ha), medium in phosphorus (17.97 kg/ha) and high in available K (308.12 kg/ha). The 16 treatments comprising of four weed control practices viz. Pendimethalin 38.7% CS 1 kg *a.i.* /ha as PPI, Hand Weeding at 30 DAS, Hand Hoeing at 30 DAS and Control (No weed control) as a main plot treatments and four crop mulch *viz.,* Wheat straw 5 t/ha, Paddy straw 5 t/ha, Soybean straw 5 t/ha and Control (No mulch) were assigned in sub plot treatments and were laid out in a split plot design with three replications. Chickpea variety 'JG 14' which is early maturing and heat tolerant variety, developed by JNKVV, Jabalpur in 2009 and potential yield 18-19 q/ha was sown in row 30 cm apart, using 80 kg/ha seeds. Fertilization is done in chickpea @ 20 kg N, 60 kg P_2O_5 and 20 kg K_2O/ha as basal dose by urea, single super phosphate (SSP) and muriate of potash, respectively. Application of pendimethalin as PPI was applied before 2 DAS with hand knapsack sprayer fitted with flat-fan nozzle at spray volume of 500 l/ha and crop straw mulches were spread after seed emergence. Weed prevalence and weed biomass were recorded at 30 DAS with the help of 1 x 1 m quadrate by dropping randomly at two places in each plot. Weeds were removed and species wise weed dry weight was recorded after drying in hot air oven (60 ± 1^0C for 24 hours). Weed control efficiency was also calculated at 30 DAS. Soil Moisture was calculated by aluminum box method on the basis of fresh and oven dry weight of soil. Growth parameters *viz.,* plant height; branches per plant, nodule per plant, crop biomass were recorded at different time intervals. Yield attributing traits *viz.,* pods per plant, seeds per pod and seed index (100 seed weight) were recorded at maturity. Finally, seed and haulm yields were recorded treatment wise. Weed control efficiency, harvest index, weed index and economic viability of treatments, soil moisture and temperature above and below the mulch and soil microbial count were determined from the data generated. Tabulation and statistical analysis of data have been done for testing the significance of variation among the different treatments with the OPSTAT software which are summarized here under.

RESULTS AND DISCUSSION

Associated weed flora

Chickpea field was infested by dicot weed. In the experimental area, chickpea field infested with *Cichorium intybus* (26%), *Medicago truncatula* (28%) and *Melilotus indica* (18%). However, other weeds like, *Anagalis arvensis* (14%) and *Chenopodium album* (14%) was also present in less numbers Figure 1 show the per cent of dominant weeds in the experiential area. Sahu *et al.* (2020), Jha *et al*., 2014, Tanisha *et al*., 2022 and Patel *et al*., 2023 also reported similar weeds in Jabalpur region.

Weed density and dry weight

Weed density and weed dry weight in 2018–19 and 2019–20 at 30 DAS presented in table 1 and 2. Hand weeding done at 30 DAS recorded lower population and weed biomass of *Cichorium intybus, Medicago*

Table 1. Effect on weed control practices and straw mulches on density of weeds at 30 DAS during *rabi* 2018–19 and 2019–20

Treatment	Weed density (no./m^2)									
	Cichorium intybus		*Medicago truncatula*		*Melilotus indica*		*Anagalis arvensis*		*Chenopodium album*	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Weed control practices										
Pendimethalin	4.41	4.86	4.09	4.52	2.91	3.33	3.30	3.59	3.02	3.34
1kg *a.i.*/ha as PPI	(19.83)	(23.83)	(16.83)	(20.50)	(8.17)	(10.83)	(10.50)	(12.50)	(8.83)	(10.83)
Hand weeding at 30 DAS	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Hand hoeing at 30 DAS	3.46	4.00	2.87	3.45	2.57	3.04	3.07	3.39	2.49	2.87
	(11.67)	(15.67)	(7.83)	(11.50)	(6.33)	(9.00)	(9.17)	(11.17)	(5.83)	(7.83)
Weedy check	5.59	5.95	5.69	6.00	4.27	4.58	4.33	4.56	4.13	4.37
	(32.67)	(36.67)	(32.17)	(35.67)	(19.50)	(22.17)	(18.33)	(20.33)	(16.67)	(18.67)
SEm±	0.33	0.30	0.18	0.18	0.28	0.27	0.11	0.09	0.05	0.05
CD (P=0.05)	1.15	1.07	0.65	0.63	1.00	0.94	0.37	0.33	0.18	0.16
Straw Mulches 5 t/ha										
Wheat straw	3.40	3.74	3.21	3.55	2.53	2.83	2.77	2.98	2.38	2.63
	(14.33)	(17.33)	(12.17)	(15.00)	(8.00)	(10.00)	(8.67)	(10.17)	(6.00)	(7.50)
Paddy straw	2.94	3.34	2.74	3.13	2.06	2.42	2.42	2.66	2.10	2.38
	(10.50)	(13.50)	(9.33)	(12.00)	(4.67)	(6.67)	(6.50)	(8.00)	(4.83)	(6.33)
Soybean Straw	3.63	3.96	3.53	3.83	2.79	3.07	3.00	3.20	2.81	3.03
	(16.83)	(19.83)	(15.50)	(18.00)	(9.17)	(11.17)	(10.50)	(12.00)	(9.33)	(10.83)
No Mulch	4.20	4.48	3.88	4.17	3.08	3.34	3.22	3.40	3.04	3.24
	(22.50)	(25.50)	(19.83)	(22.67)	(12.17)	(14.17)	(12.33)	(13.83)	(11.17)	(12.67)
SEm±	0.13	0.12	0.05	0.05	0.07	0.07	0.03	0.03	0.05	0.05
CD (P=0.05)	0.39	0.35	0.16	0.15	0.20	0.20	0.10	0.09	0.15	0.14

Figures in parenthesis are original values and have been transformed ($\sqrt{X+0.5}$) before statistical analysis, NS= Non Significant

Table 2. Effect on weed control practices and straw mulches on dry weight of weeds at 30 DAS during *rabi* 2018–19 and 2019–20

Treatment	Weed dry weight (g/m^2)									
	Cichorium intybus		*Medicago truncatula*		*Melilotus indica*		*Anagalis arvensis*		*Chenopodium album*	
	2018–19	2019–20	2018–19	2019–20	2018–19	2019–20	2018–19	2019–20	2018–19	2019–20
Weed control practices										
Pendimethalin	1.11	1.18	0.93	0.97	0.82	0.86	0.79	0.80	0.81	0.84
1kg *a.i.* ha^{-1} as PPI	(0.77)	(0.92)	(0.38)	(0.46)	(0.18)	(0.25)	(0.12)	(0.14)	(0.16)	(0.20)
Hand weeding at 30 DAS	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Hand hoeing at 30 DAS	0.97	1.05	0.81	0.85	0.79	0.83	0.77	0.78	0.78	0.80
	(0.46)	(0.61)	(0.15)	(0.23)	(0.13)	(0.20)	(0.09)	(0.11)	(0.11)	(0.15)
Weedy check	1.55	1.62	1.19	1.23	1.02	1.05	0.88	0.89	0.96	0.98
	(2.07)	(2.30)	(0.95)	(1.04)	(0.58)	(0.66)	(0.26)	(0.29)	(0.41)	(0.46)
SEm±	0.07	0.07	0.04	0.04	0.03	0.04	0.01	0.01	0.01	0.01
CD (P=0.05)	0.24	0.23	0.13	0.14	0.11	0.12	0.02	0.02	0.02	0.02
Straw Mulches 5 t/ha										
Wheat straw	1.01	1.06	0.87	0.90	0.81	0.84	0.78	0.79	0.79	0.80
	(0.58)	(0.70)	(0.25)	(0.32)	(0.17)	(0.22)	(0.10)	(0.12)	(0.11)	(0.14)
Paddy straw	0.91	0.96	0.81	0.84	0.76	0.79	0.75	0.76	0.77	0.78
	(0.36)	(0.46)	(0.18)	(0.22)	(0.09)	(0.13)	(0.07)	(0.08)	(0.09)	(0.11)
Soybean Straw	1.14	1.20	0.92	0.95	0.84	0.87	0.80	0.81	0.84	0.86
	(0.98)	(1.13)	(0.38)	(0.43)	(0.22)	(0.28)	(0.14)	(0.16)	(0.21)	(0.25)
No Mulch	1.28	1.33	1.03	1.07	0.93	0.96	0.82	0.83	0.87	0.89
	(1.37)	(1.54)	(0.67)	(0.75)	(0.41)	(0.47)	(0.18)	(0.20)	(0.27)	(0.31)
SEm±	0.024	0.023	0.013	0.014	0.014	0.014	0.002	0.002	0.004	0.004
CD (P=0.05)	0.39	0.35	0.16	0.15	0.20	0.20	0.10	0.007	0.15	0.14

Figures in parenthesis are original values and have been transformed ($\sqrt{X+0.5}$) before statistical analysis, NS= Non Significant

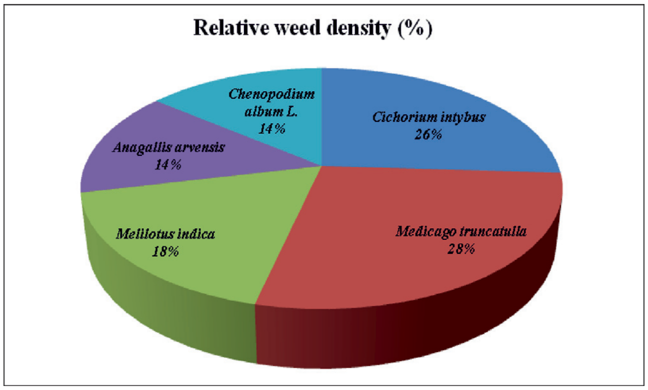

Figure 1. Relative weed density at 30 DAS (Mean data of 2 year)

truncatula Melilotus indica, Anagalis arvensis and Chenopodium album because all weeds were eliminated manually from the field during critical period to provide favourable environment for crop growth. Application of pendimethalin 38.7% CS 1 kg a.i. /ha as PPI recorded lower weed density and dry weight of *, Cichorium intybus* (19.83 and 23.83/m^2 and 0.77 and 0.92 g/m^2)*,Medicago truncatula* (16.83 and 20.50/m^2 and 0.38 and 0.46 g/m^2) *Melilotus indica* (8.17 and 10.83 no. /m^2 and 0.18 and 0.25 g/m^2)*, Anagalis arvensis* (10.50 and 12.50/m^2 and 0.12 and 0.14 g/m^2) and *Chenopodium album* (8.83 and 10.83/m^2 and 0.16 and 0.20 g/m^2) over weed check due to check the weed growth through checking cell division resultant lower weed density and dry weight was recorded. hand hoeing done at 30 DAS also recorded lower weed density and dry weight due to same observational day operation. It cut down inter row weeds but not cut intra row weeds. Sneha (2020), Sahu *et al* 2020a, Yadav *et al.* 2023, Jha and Kewat 2013 and Tiwari *et al.* 2011a also presented similar results. Maximum weed density and dry weight of different weed species were recorded in control plots due to uninterrupted growth of all weed during critical period of crop growth.

Paddy straw at the rate of 5 t/ha recorded lower density and dry weight of *Cichorium intybus* (14.33 and 17.33/m^2 and 0.58 and 0.70 g/m^2)*, Medicago truncatula* (12.17 and 15.00 no. /m^2 and 0.25 and 0.32 g/m^2)*, Melilotus indica* (8.0 and 10.0 no. /m^2 and 0.17 and 0.22 g/m^2)*, Anagalis arvensis* (8.67 and 10.17/m^2 and 0.10 and 0.12 g/m^2) and *Chenopodium album* (6.50 and 7.50/m^2 and 0.11 and 0.14 g/m^2) over all the mulches in 2018-19 and 2019-20 respectively. Paddy straw provide uniform covering of row space between crop plants and reduce light and air availability to the various weed species. Wheat straw also provide good control of all weed species in relation to weed density and dry weight over no mulch but statistically similar to soy bean straw mulch at the rate of 5 t/ha. Among the straw mulch, no mulch plots recorded higher density and dry weight of all weed species due to uninterrupted growth of all weed species during critical growth period (Sahu *et al.,* 2022 and Jagat *et al*., 2009).

Weed control efficiency

Weed control efficiency was significantly affected by weed control treatments in chickpea. Maximum weed control efficiency of *Cichorium intybus, Medicago truncatula, Melilotus indica, Anagalis arvensis and Chenopodium album* (100% WCE) were recorded in hand weeding at 30 DAS. It was due to elimination of weed, lower weed density and dry weight were recorded and caused receiving maximum weed control efficiency over all the treatments. Hand hoeing at 30 DAS (1 kg *a.i./*ha as PPI) also provide higher weed control efficiency of *Cichorium intybus* (77.97 and 73.61%), *Medicago truncatula* (84.08 and 78.31%)*, Melilotus indica* (77.33 and 69.12%), *Anagalis arvensis* (69.12 and 61.22%) and *Chenopodium album* (73.08 and 68.03 %) followed by pendimethalin 1kg/ ha due to presence of lower weed biomass. The weed control efficiency was minimum under weedy check plots where weed control was not done it was due more weeds during the critical period (Jha *et al.* 2014, Notsari *et al*. 2017 and Tiwari *et al.* 2011a).

No mulch recorded lower weed control efficiency of various weed species due to absence of any mulch material between row space weed severities was more in respective plots.Weed control efficiency was slightly increase in soybean straw mulch (5 t/ha). It was due to suppression of all weeds increased weed control efficiency of weeds slightly. Wheat straw mulch (5 t/ha) increased weed control efficiency of *Cichorium intybus, Medicago truncatula, Melilotus indica, Anagalis arvensis* and *Chenopodium album*by (72.01 and 69.73, 73.32 and 69.79, 70.72 and 66.50, 66.50 and 60.53 and 72.51 and 69.31%, respectively). Among straw mulches, paddy straw (5 t/ha) recorded maximum weed control efficiency (82.34 and 79.82, 81.13 and 78.47, 85.20 and 79.71, 79.71 and 72.52 and 79.07 and 75.96% in 2018-19 and 2019-20, respectively) and proved superior to other straw mulches due to proper covering of space between two row and reduce availability of light and air weed incidence was reduced (Singh and Guru, 2011).

Soil Moisture pattern

Soil moisture content not affected significantly by weed control treatments, but among straw mulches, paddy straw mulch at the rate of 5 t/ha received significantly higher soil moisture (15.75 and 22.63% respectively) at 30 DAS in chickpea. It was due to proper covering of openspace reduces the direct exposure of sun light and air reduces water loss from evapo-transpiration in the soil profile resultant more soil moisture was store in the soil. Wheat and

Table 3. Effect of weed control practices and straw mulches on yield attributing characters and yield of chickpea at 2018–19 and 2019–20

Treatment	Yield attributing characters						Yield				Economics	
	Pods/plant		Seeds/pod		Seed index (%)		Seed yield (kg/ha)		Haulm yield (kg/ha)		B:C ratio	
	2018–19	2019–20	2018–19	2019–20	2018–19	2019–20	2018–19	2019–20	2018–19	2019–20	2018–19	2019–20
Weed control practices												
Pendimethalin 1 kg *a.i.*/ha as PPI	41.48	45.55	1.64	1.74	15.12	15.20	1,421	1,561	3,351	3,191	1.78	2.02
Hand weeding at 30 DAS	44.83	48.92	1.70	1.80	14.98	15.06	1,604	1,731	3,719	3,559	1.80	1.98
Hand hoeing at 30 DAS	33.25	35.95	1.62	1.72	14.78	14.86	1,208	1,322	2,989	2,829	1.54	1.76
Weedy check	20.17	21.23	1.60	1.70	14.85	14.93	869	868	2,673	2,513	1.17	1.24
SEm±	1.24	1.49	0.06	0.06	0.85	0.85	89.29	86.42	127.32	127.32		
CD (P=0.05)	4.39	5.25	NS	NS	NS	NS	314.99	304.86	449.138	449.13		
Straw Mulches 5 t/ha												
Wheat straw	37.57	39.90	1.68	1.78	14.99	15.07	1,339	1,469	3,325	3,165	1.44	1.62
Paddy straw	40.38	44.58	1.70	1.80	15.20	15.28	1,515	1,593	3,497	3,337	1.80	1.98
Soybean Straw	32.13	35.58	1.59	1.69	14.79	14.87	1,187	1,279	2,968	2,808	1.43	1.61
No Mulch	29.65	31.58	1.59	1.69	14.75	14.83	1,062	1,143	2,941	2,781	1.61	1.79
SEm±	1.00	0.97	0.04	0.04	0.22	0.22	36.76	56.45	106.72	106.72		
CD (P=0.05)	2.95	2.84	NS	NS	NS	NS	107.94	165.73	313.36	313.357		

wheat straw mulch at the rate of 5 t/ha also increase soil moisture due to minimization in sun light penetration in to the soil. Among the mulch treatment, no mulch plot recorded lower soil moisture during both the years (10.49 and 12.55 %, respectively) at 30 DAS (Sahu *et al.,* 2020a).

Yield attributes

Yield attributing traits, only pods per plant were affected significantly due to weed control treatments. However, seeds per pod and seed index were remained unaffected under different weed control treatments since this character are governed by genetic factors. Among all the treatments, minimum numbers of pods per plant were recorded under weedy check plots (20.70). Thin and lanky crop plants under severe weed stress, could not assimilate and partitioned enough photosynthates for formation of pods in crop plants hence led to minimum number of pods per plant in weedy check plots. But pods per plant increased marginally in the plots receiving hand hoeing at 30 DAS due to better growth and partitioning of photosynthates under poor weed dry weight and density than check plots. The pods per plant were significantly higher in plots receiving application of pendimethalin (1 kg *a.i.*/ha as PPI). Better growth and development under these treatments resulted in more flowers and better fertilization, which in turn favoured more pod formation as confirmed by Sneha (2019). However, hand weeding done at 30 DAS had the highest number of pods/plant due to timely removal of weeds coupled with pulverization of soil, which encouraged better growth and development of flowers including their fertilization and finally recorded maximum pods per plant (Chaudhary *et al.*, 2005 and Chandrakar *et al.*, 2015) . Similarly pods/plant were significantly influenced due to application of various straw mulches. However, seeds/pod and seed index were remained unchanged under various straw mulch applications. This character is regulated by genetic factors. The pods per plantwere minimum under check plots where no mulch was applied due to severe crop-weed competition during critical period and poor growth of crop plants. Soybean straw mulch (5 t/ha) increased pods per plant marginally (9.57%) due to utilization of growth resources and healthy and taller plants in comparison to check plots. However, wheat straw mulch (5 t/ha) caused further increase in the pods per plant due to better growth and development under these treatments, resulting in more flower initiation and fertilization in the plants. However, paddy straw when applied in chickpea (5 t/ha) recorded maximum pods per plant (42.48). Optimum utilization of water, light, space and nutrient by the plants led to produce more flowers and better partitioning of photosynthates from source to sink and finally more number of pods per plant than other mulches Jagat *et al.,* (2009).

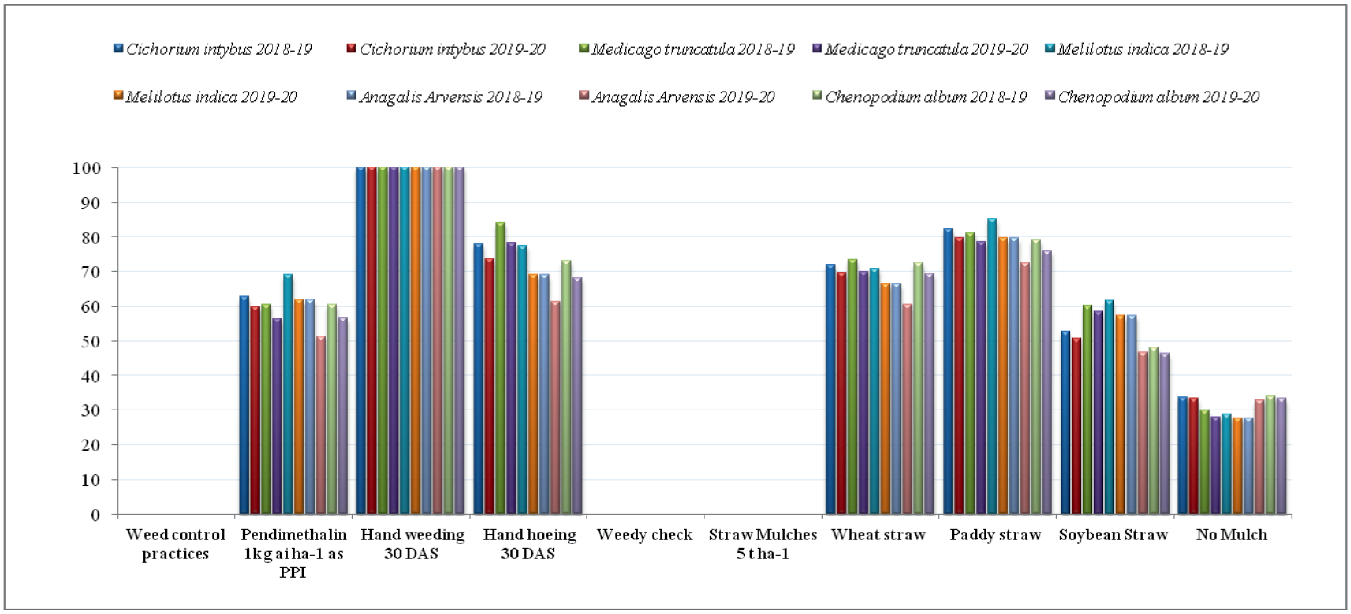

Fig. 1. Effect of weed control practices and straw mulches on weed control efficiency at 30 DAS 2018–19 and 2019–20

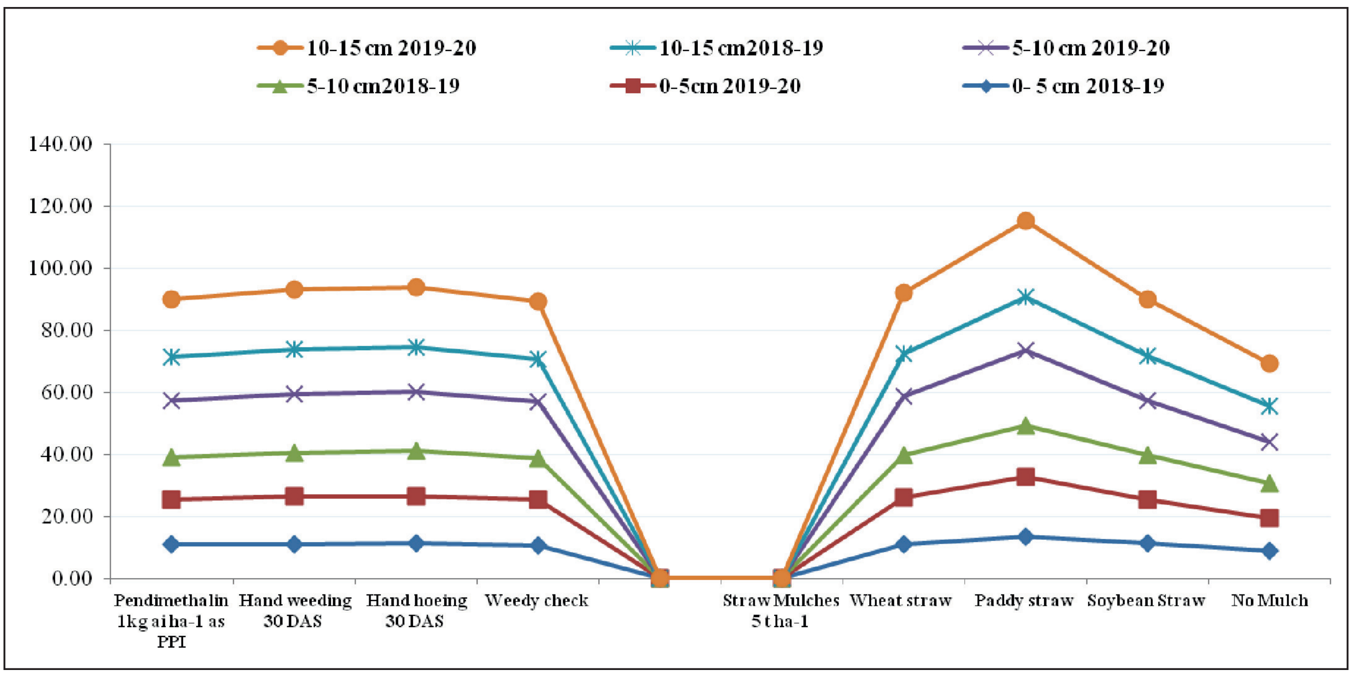

Fig. 2. Effect of weed control practices and straw mulches on soil moisture content (0-5,5-10 and 10-15cm depth) at 30 DAS 2018–19 and 2019–20

Yields

Weed control treatments affect seed and haulm yield significantly. Among weed control treatment lower seed yield (869 and 868 kg/ha) and haulm yield (2673 and 2513 kg/ha) was recorded in weedy check plots. It was due to more crop weed competition during critical period resultant less photosynthetic material was accumulated. it was increased appreciably in plots receiving mechanical and chemical weed control. Pendimethalin at the rate of 1 kg *a.i*/ha as PPI increase seed yield (1,421 and ,1561 kg/ha) and haulm yield (3351 and 3190 kg/ha) of chickpea due to proper control of weeds during critical growth period resulting more source and sink was available to the plants. It was at par with hand hoeing at 30 DAS. Among weed control treatment, maximum seed yield (1,604 and 1,731 kg/ha) was recorded in hand weeding done at 30 DAS and proved significantly superior over other weed control treatments due to elimination of all sort of weeds during critical period but it was at par to pendimethalin 1 kg a.i./ ha. Sahu *et al*., (2020) also reported similar result. Application of straw mulches affects seed and haulm yield of chickpea significantly. Among straw mulches minimum seed (1062 and 1143 kg/ha), haulm (2941 and 2781 kg/ha) due to severe crop weed competition during critical period resultant lower seed and haulm yield were recorded. However, soybean straw mulch (5 t/ha) increased seed and haulm yield slightly. But wheat straw mulch (5 t/ha) increase seed yield appreciably. But application of paddy straw (5 t/ha) recorded maximum seed yield (1515and 1593 kg/ha) and proved significantly superior to other straw mulches due to proper suppression of weeds during critical period resulting higher seed yield (Sahu *et al*., 2020 and Choudhary *et al.,* 2012). Among weed control treatment lower B:C ratio was recorded in control plots. Hand weeding received higher B:C ratio (1.80) in 2018-19, but pendimethalin 1 kg/ha received higher B:C ratio (2.02) in 2019-20.Among straw mulches paddy straw received higher b:c ratio (1.80 and 1.98) in 2018-19 and 2019-20 respectively. However, no mulch plots had lower B:C ratio due to higher weed growth resulting in less economic yield and hence lower B:C ratio was recorded.

CONCLUSION

From this study it may be concluded that minimum density of grassy and total weeds and dry-matter accumulation by them at all stages was observed in hand weeding done at 30 DAS, being statistically at par with application of pendimethalin 38.7% CS application 1 kg/ha as PPI. The higher seed yield, haulm yield and B: C ratio gave in with application of pendimethalin1 kg/ha and similar to hand weeding. Application of paddy and wheat straw mulch 5 t/ ha significantly lowered weed density and dry weight, increased weed control efficiency resulting recorded higher yield attributes, yield and B:C ratio of chickpea.

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