Assessment of bio-inoculant, FYM, and chemical fertilizer on the growth attribute and yield of horsegram [*Macrotyloma uniflorum* (Lam.) Verdc.] in Chhattisgarh plain

ABSTRACT

A field experiment was carried out during at Barrister Thakur Chhedilal Collage of Agriculture and Research station, Bilaspur, Indira Gandhi Krishi Vishwavidyalya, Raipur, Chhattisgarh during post *kharif* season 2020-21 entitled with **"Assessment of bio-inoculant, FYM, and chemical fertilizer on the growth attribute and yield of horsegram [*Macrotyloma uniflorum* (Lam.) Verdc.] in Chhattisgarh plain"** including organic and inorganic nutrients source with recommended dose of fertilizers (RDF) 20:40:20 NPK kg ha^{-1} was layout at randomized block design (RBD) with nine treatments and three replications, taking variety of horsegram "Bilasa Kulthi ". Result revealed that between the different organic and inorganic treatments T_6 (100% RDF + *Rhizobium culture* + PSB) result indicated that the highest seed yield (865.24 kg ha^{-1}) was observed which was significantly superior over other treatments but it was at par with T_4 (100% RDF + *Rhizobium culture*) with seed yield (819.40 kg ha^{-1}) closely followed by the treatments of T_5 (75% RDF + 25% N through FYM + *Rhizobium culture*) with **(**743.24 kg ha^{-1}) and T_8 (50% RDF + 50% N through FYM + *Rhizobium* culture + PSB) with (661.50 kg ha^{-1}) , plant population (40.46 plants m^2) and plant height is (75.11) cm of horsegram. The higher growth attributes characters under the T_6 has been affiliated with significantly superior is number of primary branch $plant^{-1}$ (5.98) , Crop growth rate (0.081) g plant $^{-1}$ day $^{-1}$. Relative growth rate (0.015g g^{-1} day^{-1}) Net assimilation rate (0.029 g dm^{-2} day^{-1})

Key words: Horsegram, growth attributes, organic and inorganic inputs.

INTRODUCTION:-

Pulses play important role in agriculture next to cereals. These are the major source of dietary protein, along with minerals and vitamins. It is the second rich source of dietary protein in vegetarian diet in our country and also in other developing countries. Among the pulses, horsegram is an important post season *kharif* crop of the country commonly known as "Kulthi" belongs to the family fabaceae. It has diploid chromosome numbers of 2n = 20 (Cook *et al*., 2005). Horsegram is grown with mixed crop,. The crop duration of horsegram is 100 – 110 days. The average yield is about 350-800 kg ha^{-1}. It is known for its medicinal use and nutritional quality. It is consumed as a whole seed and as sprouts in India.

Horsegram used traditionally as a medicinal crop famous for its medicinal uses because different parts of the plant are used for the treatment of asthma, bronchitis, urinary disorder, lowering cholesterol levels and kidney stones (Ghani, 2003). In India, horsegram occupies an area of 460.40 (000 ha) with a production of 181.29 (000 tonnes) with an average national productivity of 394 kg ha^{-1} (Anonymous, 2018-19). Horsegram is important pulse crop mostly grown in Karnataka, Odisha, Chhattisgarh, Andhra Pradesh, Tamil Nadu and Maharashtra which together contributes about 89.23 per cent area and 86.10 per cent production. Higher productivity of horsegram is obtained in Bihar (1000 kg ha^{-1}). In Chhattisgarh, horsegram occupies an area of 40.15 (000 ha) with a production of 15.20 (000 tonnes) and average productivity of 379 kg ha^{-1} (Anonymous, 2018-19). Horsegram is an important pulse crop of the state and mostly grown in Sarguja, Jagdalpur, Kanker, Korba and Jashpur which together contributes about 69.74 per cent area and 76.61 per cent production. However, the productivity of horsegram is highest in Janjgir (388 kg ha^{-1})

MATERIALS AND METHODS

The present research was carried out during post *kharif* season 2020 at Instructional Farm, BTC College of Agriculture and Research Station, Bilaspur (C.G.), which was situated in dry moist, sub-humid region at an altitude of 292 m above mean sea level on 22.09˚N latitude and 82.12˚E longitude. The soil of the experimental site was sandy-clay in texture. The Horsegram (var. Bilasa kulthi) was grown and treatments were replicated three times in RBD. The
experiment consists of nine treatments *viz.*, T_1 :- 100% RDF, T_2 :- 75%RDF + 25% N through FYM, T_3 :- 50% RDF + 50% N through FYM ,T_4 :- 100% RDF + *Rhizobium* culture, T_5 :- 75% RDF + 25% N through FYM + *Rhizobium* culture, T_6 :- 100% RDF + *Rhizobium* culture + PSB T_7 : 50% RDF + 50% N through FYM + *Rhizobium* culture ,T_8 : 50% RDF + 50% N through FYM + *Rhizobium* culture + PSB T_9 :- Control plot The crop was sown on 11th September, 2020 and harvesting was done on 18th December, 2020.

The weekly maximum and minimum temperature recorded during growing period of crop was 28.7^{o}C in 37th standard week of September and 8.0^{o}C 51th standard week of December and the average maximum and minimum relative humidity was 83.05% and 43.4% on 49th and 45th standard week of (December and November) respectively, the highest sunshine hours during crop growing period was recorded 7.8 hours and the total mean weekly rainfall of 52.8mm was on 40th standard week of September respectively obtained during crop growth period from September to December, 2020.

The experimental area was prepared by ploughing once and harrow twice for obtain good tilth. The field was finally levelled to ensure uniform irrigation and proper drainage. Then the experimental field was laid out as per the plan of layout. The urea, single super phosphate and muriate of potash are used to supply plant nutrients i.e. nitrogen, phosphorus and potash respectively. The required quantities of all fertilizers were mix well together and there after fertilizer are applied in furrow as a basal dose. After the preparation of field, the seed was taken up at a seed rate of 20 kg ha^{-1}. Before sowing the healthy seeds were selected and treated with carbendazim (12 % WP) @ 2 g kg^{-1} of seed. Followed by *Rhizobium* @ 10 g and PSB culture @ 10 g kg^{-1} of seed to avoid damage caused by seed borne disease of crop. The furrows were opened with the help of kudali and seed were sown in the depth of 3-4 cm, there after covering the furrow with soil and maintain row to row spacing at 30 cm.

Harvesting was done manually when the maturity symptoms were observed. The border row were firstly harvested, kept separately and treated as bulk. Then, plants from net plots were harvested. The tagged plants were removed from each plot separately. Threshing was done separately of net plot and border row by beating with sticks. Then grain were separated, winnowed, weighted and net plot yield was recorded treatment wise.

RESULT AND DISCUSSION

Effect of INM on growth attributes and yields of horsegram :

Plant population (m^{-2}) was recorded at 25 days after sowing and harvesting stage of the crop 25 DAS was observed that highest number of plant population recorded in T_6 (100% RDF + *Rhizobium* culture + PSB), is (40.46 plant m^{-2}). The lowest number of plant population recorded (38.53 plants m^{-2}) was recorded in treatment T_9 (Control). At harvest was observed that highest number of plant population recorded in T_6 (100% RDF + *Rhizobium* culture + PSB), is (38.43 plant m^{-2}). The lowest number of plant population recorded (36.29 plants m^{-2}) was recorded in treatment T_9 (Control).

At 25 DAS the data varies in plant height were found significant and treatment T6 (100% RDF + Rhizobium culture + PSB), earned significantly larger plant height (20.32 cm) at par with T_4 (100% RDF + Rhizobium culture), is (20.26 cm) and T_5 (75% RDF + 25% N through FYM + Rhizobium culture), is (18.85 cm) .The lowest plant height (14.45 cm) was recorded in treatment T9 (Control). Almost similar trend was also observed at 50 DAS. At harvest, height of plant was observed declined with respect to 75 DAS. Significantly higher plant height was recorded in T6 (100% RDF + Rhizobium culture + PSB),

earned significantly larger plant height (75.11 cm) at par with T4 (100% RDF + Rhizobium culture), is (72.94 cm) and T5 (75% RDF + 25% N through FYM + Rhizobium culture), is (70.40 cm) .The lowest plant height (58.25 cm) was recorded in treatment T9 (Control).

Treatment T_6 (100% RDF + *Rhizobium* culture + PSB) recorded significantly the higher number of primary branches (2.80) plant^{-1} , however, it was found at par with T4 (100% RDF + *Rhizobium* culture), is (2.69) plant^{-1} and T_5 (75% RDF + 25% N through FYM + Rhizobium culture), is (2.01) plant^{-1} . Significantly lower number of primary branches plant-1 (1.20) plant-1 was observed under treatment T_9 (control). The same trend followed at the time at 50 DAS and 75 DAS in number of primary branches plant^{-1}. At in number of primary branches plant^{-1} . Treatment T_6 (100% RDF + *Rhizobium* culture + PSB) recorded significantly the higher number of primary branches (5.95) plant^{-1} . It was found at par with T4 (100% RDF + *Rhizobium* culture), is (5.75) plant^{-1} and T5 (75% RDF + 25% N through FYM + Rhizobium culture), is (5.70) plant^{-1} . Significantly lower number of primary branches plant-1 (3.79) plant^{-1} was observed under treatment T9 (control).

Crop growth rate (g plant^{-1} day^{-1}) The data present in Table found that between 25-50 days after sowing among the treatment higher crop growth rate in T6 (100% RDF + Rhizobium culture + PSB) is (0.140 g plant^{-1} day^{-1}) and lower crop growth rate in T9 (Control) is (0.116 g plant^{-1} day^{-1}) At 50-75 days after sowing among the treatment higher crop growth rate in T6 (100% RDF + *Rhizobium* culture + PSB) is (0.130 g plant^{-1} day^{-1}) and lower crop growth rate in T9 (Control) is (0.112 g plant^{-1} day^{-1}) At 75 DAS- at harvest among the treatment higher crop growth rate in T6 (100% RDF + Rhizobium culture + PSB) is (0.081 g plant^{-1} day^{-1}) and lower crop growth rate in T9 (Control) is (0.049 g plant^{-1} day^{-1}).

Relative growth rate (g g^{-1} day^{-1}) The data present in Table found that between 25-50 days after sowing among the treatment higher relative growth rate in T_6 (100% RDF + Rhizobium culture + PSB) is (0.058 g g^{-1} day^{-1}) and lower relative growth rate in T_9 (Control) is (0.038 g g^{-1} day^{-1}) At 50-75 days after sowing among the treatment higher relative growth rate in T6 (100% RDF + Rhizobium culture + PSB) is (0.028 g g^{-1} day^{-1}) and lower relative growth rate in T9 (Control) is (0.017 g g^{-1} day^{-1}) At 75 DAS- at harvest among the treatment higher relative growth rate in T6 (100% RDF + Rhizobium culture + PSB) is (0.015 g g^{-1} day^{-1}) and lower relative growth rate in T_9 (Control) is (0.006 g g^{-1} day^{-1}).

Net assimilation rate (g dm^{-2} day^{-1}) The data present in Table found that between 25-50 days after sowing among the treatment higher net assimilation rate (g dm^{-2} day^{-1}) in T_6 (100% RDF + *Rhizobium* culture + PSB) is (0.075 g dm^{-2} day^{-1}) and lower net assimilation rate (g dm^{-2} day^{-1}) in T_9 (Control) is (0.058 g dm^{-2} day^{-1}) At 50-75 days after sowing among the treatment higher net assimilation rate (g dm^{-2} day^{-1}) in T_6 (100% RDF + Rhizobium culture + PSB) is (0.033 g dm^{-2} day^{-1}) and lower net assimilation

rate (g dm^{-2} day^{-1}) in T_9 (Control) is (0.112 g dm^{-2} day^{-1}) At 75 DAS- at harvest among the treatment higher net assimilation rate (g dm^{-2} day^{-1}) in T6 (100% RDF + Rhizobium culture + PSB) is (0.029 g dm^{-2} day^{-1}) and lower net assimilation rate (g dm^{-2} day^{-1})in T_9 (Control) is (0.010 g $plant^{-1}$ day^{-1}).

Table 1. Effect of INM on plant population, plant height and seed yield (m^2) of horsegram :-

Treatments		Plant population (m^2)		Plant height (cm)				Seed yield
		25 DAS	At harvest	25 DAS	50 DAS	75 DAS	At harvest	(kg ha^{-1})
T_1	100% RDF	39.00	36.60	16.26	43.90	68.71	67.09	605.01
T_2	75%RDF + 25% N through FYM	39.16	37.17	16.37	44.19	69.30	67.25	630.78
T_3	50% RDF + 50% N through FYM	38.40	36.50	15.47	42.72	67.30	65.43	571.76
T_4	100% RDF + *Rhizobium* culture	40.33	38.33	20.26	49.68	74.60	72.94	819.40
T_5	75% RDF + 25% N through FYM + *Rhizobium* culture	40.23	38.23	18.85	48.56	72.31	70.40	743.24
T_6	100% RDF + *Rhizobium* culture + PSB	40.46	38.43	20.32	50.28	76.43	75.11	865.24
T_7	50% RDF + 50% N through FYM + *Rhizobium* culture	39.60	36.42	16.31	46.29	70.13	69.0	645.45
T_8	50% RDF + 50% N through FYM + *Rhizobium* culture + PSB	39.96	37.70	16.39	46.37	70.60	69.20	661.50
T_9	Control plot	38.53	36.29	14.45	40.76	61.58	58.25	343.34
	SEm ±	**0.51**	**0.55**	**1.22**	**1.36**	**1.86**	**1.47**	**45.37**

	CD(0.05)	**NS**	**NS**	**3.67**	**4.08**	**5.58**	**4.41**	**136.01**

Table 2. Effect of INM Number of primary branch plant $^{-1}$ and Crop growth rate (g plant^{-1} day^{-1}) of horsegram :-

Treatments		**Number of primary branch plant $^{-1}$**				**Crop growth rate (g pla nt^{-1} day^{-1})**		
		25 DAS	**50 DAS**	**75 DAS**	**At harvest**	**25-50 DAS**	**50-75 DAS**	**75- At harvest**
T_1	**100% RDF**	1.30	3.20	4.26	4.30	0.123	0.119	0.058
T_2	**75%RDF + 25% N through FYM**	1.45	3.25	4.60	4.81	0.128	0.121	0.061
T_3	**50% RDF + 50% N through FYM**	1.22	3.02	4.19	4.27	0.120	0.116	0.055
T_4	**100% RDF + *Rhizobium* culture**	2.69	4.79	5.75	5.83	0.136	0.129	0.075
T_5	**75% RDF + 25% N through FYM + *Rhizobium* culture**	2.01	4.65	5.70	5.75	0.134	0.127	0.071
T_6	**100% RDF + *Rhizobium* culture + PSB**	2.80	4.83	5.95	5.98	0.140	0.130	0.081
T_7	**50% RDF + 50% N through FYM + *Rhizobium* culture**	1.70	3.69	4.65	4.73	0.130	0.124	0.063

T_8	**50% RDF + 50% N through FYM + *Rhizobium* culture + PSB**	1.95	3.70	4.85	4.97	0.132	0.125	0.065
T_9	**Control plot**	1.20	2.20	3.79	3.85	0.116	0.112	0.049

Table 3. Effect of INM Relative growth rate (g g^{-1} day^{-1})and Net assimilation rate (g dm^{-2} day)of horsegram :-

Treatments		**Relative growth rate (g g^{-1} day^{-1})**			**Net assimilation rate (g dm^{-2} day^{-1})**		
		25-50 DAS	**25-50 DAS**	**75- At harvest**	**25-50 DAS**	**50-75 DAS**	**75- At harvest**
T_1	**100% RDF**	0.041	0.018	0.008	0.064	0.016	0.019
T_2	**75%RDF + 25% N through FYM**	0.046	0.022	0.010	0.062	0.021	0.021
T_3	**50% RDF + 50% N through FYM**	0.044	0.021	0.007	**0.060**	0.017	0.017
T_4	**100% RDF + *Rhizobium* culture**	0.056	0.025	0.013	0.072	0.029	0.027
T_5	**75% RDF + 25% N through FYM + *Rhizobium* culture**	0.053	0.024	0.011	0.070	0.027	0.025
T_6	**100% RDF + *Rhizobium* culture + PSB**	0.058	0.028	0.015	0.075	0.033	0.029

T_7	**50% RDF + 50% N through FYM + *Rhizobium* culture**	0.048	0.020	0.010	0.065	0.023	0.014
T_8	**50% RDF + 50% N through FYM + *Rhizobium* culture + PSB**	0.051	0.022	0.011	0.069	0.025	0.022
T_9	**Control plot**	0.038	0.017	0.006	**0.058**	0.014	0.010

Conclusions :-

It was evident from the result that growth attributes viz.," plant height, number of primary branches plant^{-1} crop growth rate , Relative growth rate (g g^{-1} day^{-1}) Net assimilation rate (g dm^{-2} day) and yield was observed to be significantly higher under treatment T_6 (100% RDF + Rhizobium culture + PSB), in horsegram crop cultivated under Chhattisgarh plains conditions.

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