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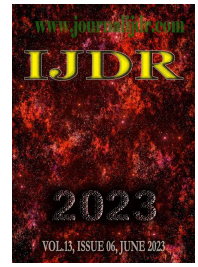
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RESEARCH ARTICLE

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CONSEQUENCE OF *VIGNA UNGUICULATA* VEGETABLES ON PRODUCTION, PRODUCTIVITY AND SOIL HEALTH MANAGEMENT

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ABSTRACT

Cow pea (*Vigna unguiculata*) is an annual herbaceous legume vegetable crop comes under family Fabaceae which is liberal to sandy to silt soil, low rain fall and an important crop of African and Asian countries. Due to its ability to grow by using less agricultural input, able to fix atmospheric nitrogen in root nodule and acts as a valuable crop for poor and marginal farming communities its cultivation is increasing Day by Day. Cow pea is also suitable as a best inter crop in fruit orchard, with other vegetables, flowers and plantation crops. Besides that whole plant is used, fruits are for vegetables, leaves are for fodder for cattle and roots are left in ground to improve soil organic matter. The experimental district Kandhamal of Odisha, India, which is situated in 19°34' & 20°50' North latitude & 83°30' & 84°48' East longitude and comes under North – Eastern Ghats agro climatic zone of the State Odisha, India. The Mean Sea Level is varies from 300 meters to 1100 meters due to the presence of hills & mountain. The favorable climatic condition suitable for agricultural farming, but due to leaching and erosion of nutrients, the soil standard is deteriorating and soil reports reflects the low nitrogen label and low to medium soil organic carbon and also farmers economical standard and minor farming communities are also barrier to adopt scientific farming system that is 31 % of land (29088 hectare) under marginal holding, 36 % of land (33868 hectare) under small operational holding, 12 % of semi medium land holding & 21 % land under medium and large land holding farming communities. Keeping the soil status and demographic agricultural pattern the experiment on “Consequence of *Vigna unguiculata* vegetables on production, productivity and soil health management” has been carried out during 2020 to 2022 at Kandhamal District of Odisha, India by using Kashi Kanchan and Utkala Manika varieties of Cow pea as recommended and farmer practice. Treatments are replicated in 10 different villages to observe the growth, production, soil nitrogen label and economics of the experiment as well. It was concluded that increase of soil Nitrogen 59.6 Kg. per hectare which was observed 28.42 % more than there before experiment. Apart from this by crop residues of *Vigna unguiculata*, soil organic carbon increases up to 42.10 % in comparison to soil data observed before experiment. It was also concluded that there is a remarkable vegetative growth and reproductive growth by treatment T₂ and an increase in yield by variety T₂ - Kashi Kanchan that is 168.11 quintal per hectare which is around 5.42 times more yield than traditional varieties. Economics of the experiment concluded that T₂ that is Kashi Kanchan variety of cow pea has best return in terms of green pod and fodder altogether around Rs. 1,67,170 / - net profit with cost benefit ratio of 1 : 2.97. By consuming of *Vigna* (Cow pea) provides us energy and make our health free from several blood, skin, hair and body weight related diseases. This crop also encourages establishment of pulse and fodder industries which have a global demand at present.

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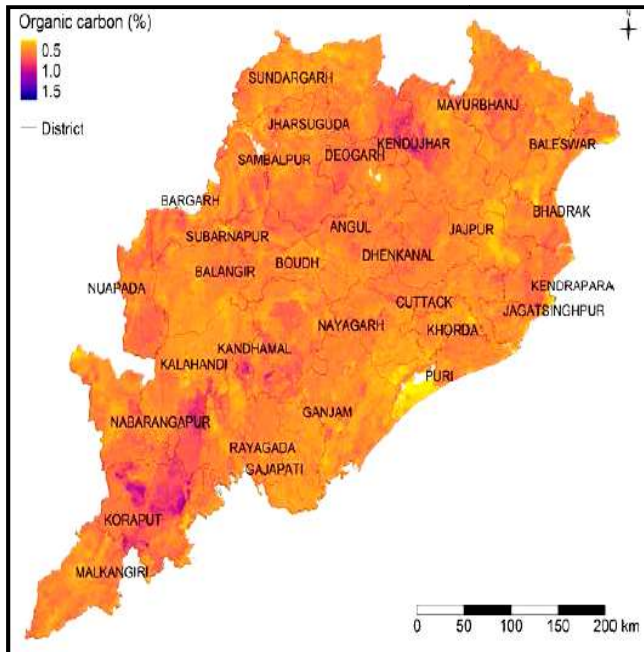
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INTRODUCTION

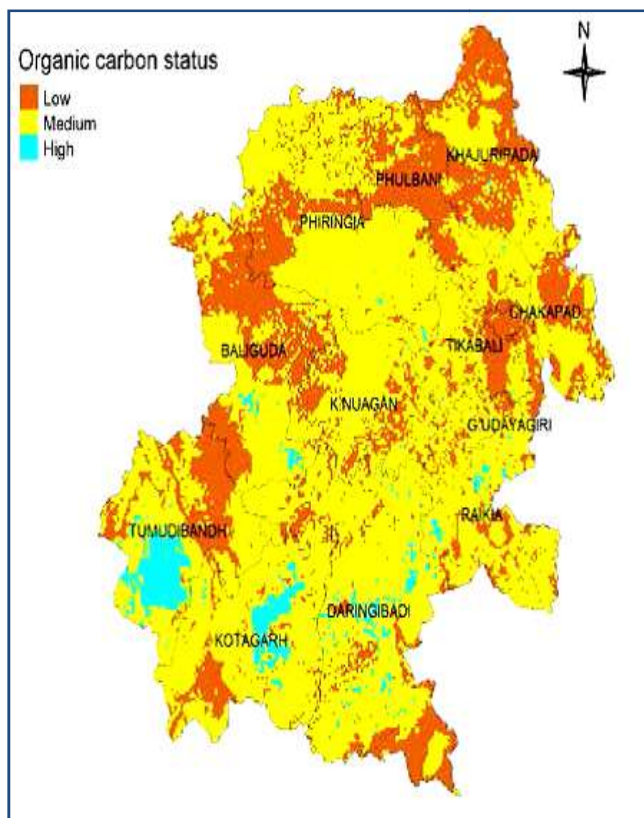
Cow pea (*Vigna unguiculata*) is an annual herbaceous legume vegetable crop which is tolerant to sandy to silt soil and low rain fall and an important crop of African and Asian countries.

Due to its ability to grow by less agricultural input, able to fix atmospheric nitrogen in root nodule and acts as a valuable crop for poor and marginal farming communities, cultivation of cow pea is increasing Day by Day. Cow pea is also suitable as a best inter crop in fruit orchard, with other vegetables, flowers and plantation crops.

Besides that whole plant is used, fruits are for vegetables, leaves are for fodder for cattle and roots are left in ground to improve soil organic matter. Apart from that due to nutritional value such as protein 24.8 %, Fats 1.9 %, Fibers 6.3 %, Carbohydrates 63.6 %, Vitamins (Thiamin 0.0007, riboflavin 0.0004 %, Niacin 0.003 %) & essential minerals 3.39 % out of 100 % of cow pea vegetable, its acts as important role in human as well as animal body growth. Diseases like high blood pressure, blood cholesterol, high sugar in human body, stomach disorder, skin diseases, hair fall, obesity and flaw control by consumption of cow pea as regular diet as green or cooked. *Vigna unguiculata* can cultivate as inter crop, mixed crop, cover crop, border crop or as dry land crop in acidic soil.



Organic Carbon % Of State Odisha, India



Organic carbon status of khandhamal, odisha, India

The experimental district Kandhamal of Odisha, India, which is situated in 19°34' & 20°50' North latitude & 83°30' & 84°48' East longitude and comes under North – Eastern Ghats agro climatic zone of the State Odisha, India. The Mean Sea Level is varies from 300 meters to 1100 meters due to the presence of hills & mountain. The favorable climatic condition suitable for agricultural farming but due to leaching and erosion of nutrients, the soil standard is deteriorating and soil reports reflects the low to medium nitrogen label and low to medium soil organic carbon in the Kandhamal District of Odisha may be due to attributed to the fact that nitrogen content is positively correlated with the organic matter content which decreases with depth. Similar findings have also been reported by Mishra et al., (2014), Dash et al., (2018) and Digal et al., (2018). It is also difficult for soil management and make it cultivable by minor tribal communities of the District, that is 31 % of land (29088 hectare) under marginal farmer holdings, 36 % of land (33868 hectare) under small farmer operational holdings, 12 % of semi medium land holding & 21 % land under medium and large land holding farming communities. Keeping the soil status and demographic agricultural pattern in view the experiment on “Consequence of *Vigna unguiculata* vegetables on production, productivity and soil health management” has been carried out at Kandhamal District of Odisha, India by using Kashi Kanchan and Utkala Manika varieties of Cow pea as recommended and farmer practice under horticulture discipline of Krishi Vigyan Kendra, Kandhamal, Odisha, India.

Aim of the Experiment: Improvement of soil health by increasing soil nitrogen label through nitrogen fixing vegetable *Vigna unguiculata* by which production and productivity increases simultaneously which ultimately improves livelihood standard of poor and marginal farming communities of North – Eastern Ghats of Odisha, India.

Advantages of Experiment: By cultivation of Cow pea advantages of Increasing in productivity, improve soil nitrogen label, sustainability, Nutritional security, environment safety, recycling of resources by incorporating cow pea plant waste in soil, less agriculture input cost and optimum harvest of next crop after legume vegetable and good source of cattle fodder in season and as silage in off season.

Focus on research: Focus on poor and marginal farm families with uncultivable land due to poor soil nitrogen and organic carbon label and they are unable to invest more to improve their soil fertility from uncultivable to cultivable, which forced them to become agricultural laborer rather than farm owner.

Scope Identified: As per the District soil status highlighting that more than 65 % of land has nitrogen label deficiency and 47 % of land having low soil organic carbon due to surface runoff, leaching, evaporation from sloppy, decrease nitrogen label with respect to soil depth – dry – variable elevation land pattern.

MATERIALS AND METHODS

This experiment has been carried out with two *Vigna unguiculata* varieties as treatments and replicated in 10 villages to analyse the suitable variety its yield, economics performances in North Eastern ghat zone of State Odisha for further horizontal spread of the experimented technology in the District which ultimately increase soil nitrogen label by nitrogen fixation in root nodule and soil organic carbon by recycling of *Vigna unguiculata* residues incorporating in soil. Collected data analysis done in statistical design R.B.D. and Standard error of Mean (SEM), CD 5 % & CV % values calculated to analyse the significance & non significance of the experiment.

T₁- Cultivation of bushy type Cowpea variety U. Manika.

T₂- Cultivation of bushy type Cowpea variety Kashi Kanchan.

The above two varieties cultivate in ten different places as replication with similar agro climatic and soil pattern that is low Nitrogen label, medium phosphorous & potash label and adoption of organic

fertilizers that is PSB @ 10 Kg. and KSB @ 10 Kg. per hectare. As Cow pea is Nitrogen fixing crop only FYM (0.5% N, 0.2 % Potassium and 0.5 % potassium) @ 15 ton / hectare applied as a source of Nitrogen which provides 75 Kg. Nitrogen per hectare. Plant to plant & row to row spacing maintained as 30 cm X 45 cm. Data of the experiment collected in different dates, analyses and evaluation of the results done statistically.

RESULTS

Data collected in various stage after showing of seeds to observed the vegetative and reproductive growth of nitrogen fixing crop at North eastern ghat zone of Odisha which eventually response to the yield of *Vigna unguiculata*. Details observed data given by treatments and replication and findings are described accordingly with showing tables and graphs.

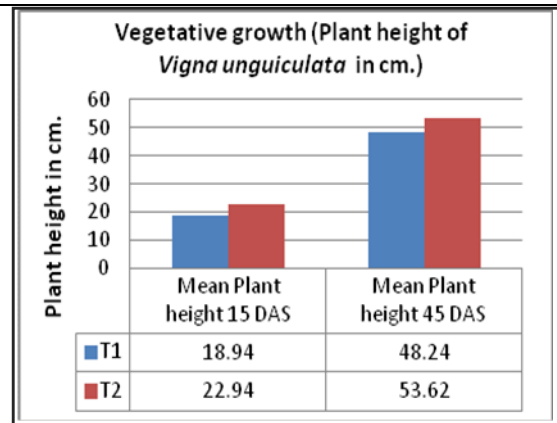
Vegetative growth (Plant height in centimeter): Vegetative growth of the experiment reveals as for table & graph number – 1 that plant height (cm.) of *Vigna unguiculata* varieties was found best with T₂ observed highest mean plant height that is 22.94 cm. and 53.62 cm. followed by T₁ 18.94 cm. and 48.24 cm. at 15 DAS (Days After Sowing) and 45 DAS respectively.

Reproductive growth (Flowers and Pods): As far as reproductive growth is concern table & graph number – 2 shows an average mean number of flowers is highest with T₂ is 14 numbers followed by T₁ is 6.1 numbers at 45 DAS and similarly mean number of pod per plant was observed best with T₂ that is 11.6 numbers of pod /plant followed by T₁ that is 3.6 number at 45 DAS.

Fruits/Pods parameters: Fruits are important factor which directly concern with yield. In the present experiment it was found among two *Vigna unguiculata* varieties, highest mean number of pods per plant observed with T₂ that is 11.6 numbers at 45 DAS and highest mean

Table No. 1. (Vegetave Growth)

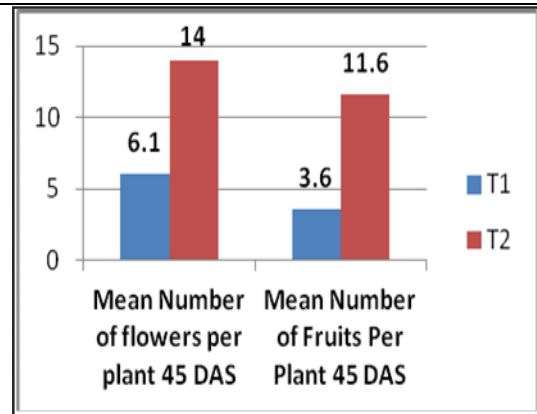
Treatments	Mean Plant height in cm. at 15 DAS	Mean Plant height in cm. at 45 DAS
T ₁	18.94	48.24
T ₂	22.94	53.62
Mean Total	20.94	50.93
SEM	0.757	1.271
CD 5%	2.422	4.067
CV %	11.44	7.89



Graph No. 01 (Vegetave Growth)

Table No 02, (Reproductive Growth)

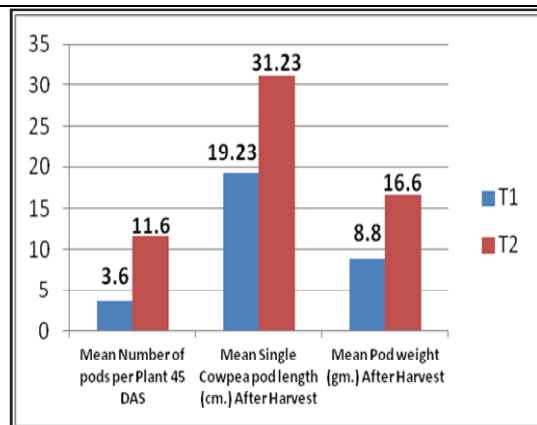
Treatments	Mean Number of flowers per plant 45 DAS	Mean Number of Pods Per Plant 45 DAS
T ₁	6.10	3.60
T ₂	14.00	11.60
Mean Total	10.05	7.60
SEM	0.600	0.658
CD 5%	1.921	2.106
CV %	18.89	27.39



Graph No. 02. Reproductive Growth)

Table 03. (Fruits & pod parameter)

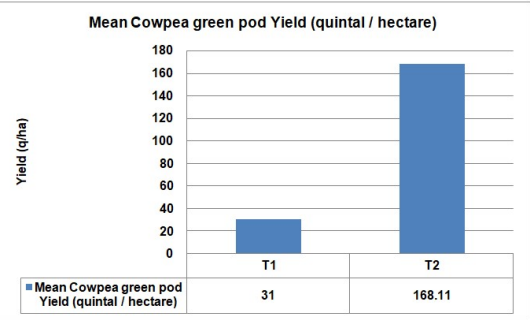
Treatments	Mean Number of pods per Plant 45 DAS	Mean Single Cowpea pod length (cm.) After Harvest	Mean Pod weight (gm.) After Harvest
T ₁	3.60	19.23	8.80
T ₂	11.60	31.23	16.60
Mean Total	7.60	25.23	12.70
SEM	0.658	0.219	0.432
CD 5%	2.106	0.701	1.382
CV %	27.39	2.75	10.76



Graph No. – 03 (Fruits & pod parameter)

Table No. 04. (Harvesting Parameter)

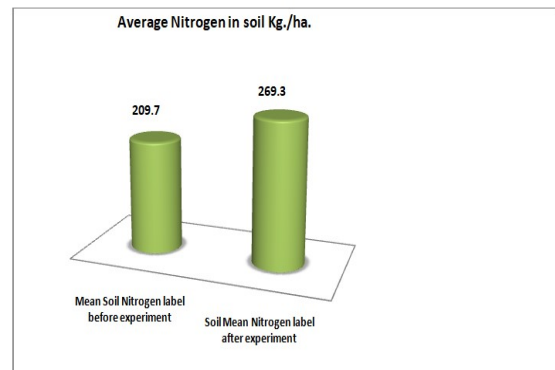
Treatments	Mean Necked Cowpea Single Seed weight (gm.)	Mean Cowpea green pod Yield (quintal / hectare)
T ₁	2.30	31.00
T ₂	3.30	168.11
Total	2.80	99.56
SEM	0.236	0.456
CD 5%	0.754	1.458
CV %	26.62	1.45



Graph No. – 04 (Harvesting Parameter)

Table No. 05 (Increase in Soil Nitrogen label)

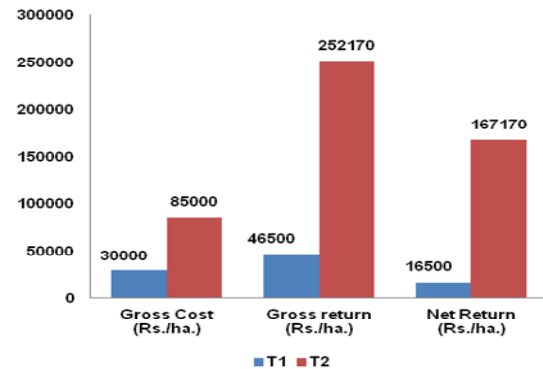
Particular of Data observation	Average Nitrogen Kg./ha.	Organic Carbon (%)	Label
Mean Soil Nitrogen label before experiment	209.7	0.38	Low
Soil Mean Nitrogen label after experiment	269.3	0.54	Medium



Graph No. – 05 (Increase in Soil Nitrogen label)

Table No. – 06 (Economics of the experiment)

Treatments	Gross Cost (Rs./ha.)	Gross return (Rs./ha.)	Net Return (Rs./ha.)	BCR
T ₁	30000	46500	16500	1.55
T ₂	85000	252170	167170	2.97



Graph No. – 06 (Economics of the experiment)



single pod length 31.23 cm. & mean single pod weight observed 16.60 grams followed by T₁ 3.6 number pod per plant, pod length 19.23 cm. and single pod weight was observed 8.8 grams respectively as shown in Table & graph number -3.

Yield Parameter (Necked Cowpea Single Seed weight in grams & Pod Yield in quintal per hectare): As revealed in the table & graph number – 4 mean necked cow pea single seed weight was observed best with T₂ that is 3.3 grams per seed and mean *Vigna unguiculata* green pod yield is about 168.11 quintal per hectare followed by T₁ mean necked single seed weight about 2.3 grams per seed and mean green pod yield was 31 quintal per hectare respectively. The important parameter of the experiment is to identify the increase in soil nitrogen label by cultivation of *Vigna unguiculata* as nitrogen fixing vegetable crops.

Results revealed in table & graph number-5 that soil nitrogen label increases from 209.7 Kg./ha (Low) that is before experiment to 269.3 Kg./ha (medium) 60 Days after harvesting, an increasing in Nitrogen percentage about 28.42 % & soil organic carbon about 42.10 %. As far as economics of the experiment is concern T₂ found highest in Net return that is Rs. 167170 per hectare and highest Cost Benefit ratio that is 2.97 followed by T₁ Rs. 16500 per hectare and BC ratio 1.55. Details shown in table & graph number -6

CONCLUSION

Experiment on “Consequence of *Vigna unguiculata* vegetables on production, productivity and soil health management” concluded that leguminous vegetables increases soil fertility label by increasing soil

nitrogen by nitrogen fixation in its root nodule. Near about 59.6 Kg. nitrogen increases per hectare which was observed 28.42 % more than there before experiment. Apart from this by crop residues of *Vigna unguiculata*, soil organic carbon increases up to 42.10 % in comparison to soil data observed before experiment.

It was also concluded that there is a remarkable vegetative growth and reproductive growth by treatment T₂ and an increase in yield by variety T₂ - Kashi Kanchan that is 168.11 quintal per hectare which is around 5.42 times more yield than traditional varieties, which has also popularity in concern to taste and pod quality. Economics of the experiment concluded that treatment two that is Kashi Kanchan variety of cow pea has best return in terms of green pod and fodder altogether around Rs. 1,67,170 / - net profit with cost benefit ratio of 1 : 2.97.

Due to its low cost of production and increase in yield, soil fertility, surplus give in of food, fodder and returns in term of rupees, this crop is popular among small, marginal, cattle growing farmer and entrepreneur of all class of agro climate & farming situation. Apart from this industries like seeds processing industry for use of *Vigna unguiculata seeds* as pulse in daily human diet, due presence of sufficient protein (24.8%), fats (1.9%), fiber (6.3 %), carbohydrates

(63.6 %), minerals (3.39 %) and presence of essential vitamins which ultimately makes our health fit and fine by preventing us from blood pressure, blood cholesterol, maintain our body sugar level, makes our skin, hair, body weight healthy and provide us energy by eating it as green salad and cooked food as well. *Vigna unguiculata* vegetable crop cultivation offers scope for fodder industries, which can provide healthy fodder to cattle's which increase their efficiency and fulfill global fodder demand.

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