

## The Effect of Natural Farming System on Growth Parameters of Redgram in Comparison to Conventional and Organic Production Systems

LAXMI<sup>1</sup>, M. T. SANJAY<sup>2</sup>, H. M. JAYADEVA<sup>3</sup>, G. GANGADHAR ESWAR RAO<sup>4</sup>,  
R. MUTHURAJU<sup>5</sup> AND PRABHU C. GANIGER<sup>6</sup>

<sup>1,2,3&4</sup>Department of Agronomy, <sup>5</sup>Department of Agricultural Microbiology,

<sup>6</sup>Department of Agricultural Entomology, College of Agriculture, UAS, GKVK, Bengaluru - 560 065

e-Mail : laxmiomkar4@gmail.com

### AUTHORS CONTRIBUTION

LAXMI :

Experimentation, design,  
manuscript writing and data  
analysis

M. T. SANJAY :

Conceptualization, design,  
manuscript editing and  
guidance

H. M. JAYADEVA;

G. GANGADHAR ESWAR RAO;

R. MUTHURAJU &

PRABHU C. GANIGER :

Manuscript editing and  
guidance

**Corresponding Author :**

LAXMI

Received : December 2025

Accepted : February 2026

### ABSTRACT

A field experiment was conducted at the Regional Institute of Organic Farming (RIOF), University of Agricultural Sciences (UAS), Gandhi Krishi Vignana Kendra (GKVK), Bengaluru during *kharif* 2022 and *summer* 2023 in redgram to study the natural farming practices in comparison to organic farming practices and crop cultivation package developed from UAS Bangalore (UASB, POP) and absolute control. The experiment was laid out in RCBD design and replicated five times. The experiment consisted of 7 treatments (T<sub>1</sub> : Absolute control, T<sub>2</sub> : Organic production system, T<sub>3</sub> : Natural farming practice T<sub>4</sub> : Natural farming+ FYM on N equivalent basis, T<sub>5</sub> : combination of natural farming and organic farming practices, T<sub>6</sub> : Farmers practice and T<sub>7</sub> : UASB POP. Among the various farming practices evaluated, UASB POP recorded significantly higher plant height (191.16 cm), number of leaves (129.69), leaf area (30.26) and total dry matter production (85.95 g) compared to the other treatments. The performance of UASB POP was statistically on par with the combined application of natural farming and organic farming practices. In contrast, the absolute control treatment registered significantly lower values for plant height, number of leaves, leaf area and total dry matter production. These results indicate that UASB POP and the combination of natural and organic farming practices were more effective in enhancing the growth parameters than the other treatments.

**Keywords :** Natural farming, Conventional farming, Organic farming, Growth in redgram

NATURAL farming (NF) is a grassroots peasant movement that is attempting to improve India's capacity to produce its food by farming with nature and ending farmers reliance on purchased inputs and credit. Natural farming is a holistic agricultural practice that counters commercial expenditure and market dependency of farmers for inputs like seeds, fertilizers and pesticides. It is seen as a way of overcoming the inability of many poor farmers to access improved seed and manufactured agro chemicals and to avoid vicious cycles of debt due to high production costs, high interest rates and volatile

market prices. These stresses have been reflected in high suicide rates of farmers; over 2,530 farmers in India have taken their own lives since 1995 (Smith *et al.*, 2020). Furthermore, substantial detrimental health impacts have been associated with the use of agrochemicals in India. The natural farming practices, avoid the use of external inputs such as synthetic fertilizers, pesticides and herbicides, in particular avoiding purchases from large corporations, so maintaining the cycle of production within villages instead of farmers obtaining inputs from cities. Therefore, it has the potential to retain more farmers

and economic resources in rural areas and be self-sustainable.

‘Natural farming’ refers to a farming approach that emphasizes the importance of coproduction of crops and animals so that synergistic effects of different parts of the system can be used, relying on easily available ‘ingredients’ to produce crops on-farm and microorganisms to build the fertility of the soil. The approach is built on the ‘four wheels’ of natural farming are (1) protection of young roots from fungal and soil-borne diseases using microbial culture, ‘*beejamrutha*’; (2) stimulation of soil microbial activity to make nutrients available to plants and protect against pathogens using a microbial inoculum, ‘*jeevamrutha*’; (3) production of stabilized soil organic matter and conservation of top soil by mulching (‘*acchadana*’) and (4) soil aeration (‘*waaphasa*’) by improving soil structure by need-based irrigation and mulching with reduced tillage. It emphasizes on efficient use of on-farm biological resources for seed and seedling treatment. By focusing on soil microorganisms and fauna and by mulching to increase soil organic matter, it is proposed that natural farming has the potential to greatly improve soil health and increase the efficiency of nutrients and water use, contributing to improving crop production. For pest management, indigenous pesticide decoctions of leaves with cow urine, *neemastra*, *bramhastra*, *agniastra*, *dashaparni*, *shuntiastra* and sour buttermilk *etc.*, are introduced (Palekar, 2006). This practice involves locally available biodegradable materials and combines scientific knowledge of ecology and modern technology with traditional farming practices based on naturally occurring biological processes. Being a cost-effective and cheap technique, it is being adopted by a large number of farmers in the country (Devakumar *et al.*, 2018). It is pertinent to mention that if organic farmers groups have a cow and their seed, then there is minimum expenditure. If farmers can manage desi cows at the farm, then expenditure in natural farming is minimal, hence is popularizing as ‘Zero budget natural farming’. In India as of today,

natural farming is practised by a large number of farmers in the production of cereals, pulses, cotton, sugarcane, banana, mango, coconut, areca nut, coffee and black pepper (Palekar, 2006).

Redgram (*Cajanus cajan*. L), is an important legume crop grown in the tropics and subtropics, mostly in Asia, Africa, Latin America and the Caribbean region occupying 6.5 per cent of the world’s total pulse area and contributing 5.7 per cent to the total pulse production. Though, India is the largest producer of redgram, contributing more than 90 per cent of the world’s production. After gram, arhar is the second most important pulse crop in the country. It is mainly eaten in the form of split pulse as ‘dal’. Its soil rejuvenation qualities such as release of soil bound phosphorous, atmospheric nitrogen fixation, recycling of soil nutrients and addition of organic matter and other nutrients make the redgram crop an ideal crop of sustainable agriculture in the tropical and sub-tropical regions of India.

India ranks first in both area and production of pulses with 35 per cent of world acreage and 29 per cent world production. Among kharif grain legumes, it occupies first place in India. These crops have wide variations in the morphological characters, root system and nutrient requirements; thereby this crop possess differential capability to utilize plant nutrients from different soil layers, resulting in better use efficiency of the applied nutrient and residual fertility (Bansilal and Nika, 2019). Redgram occupies about 15 per cent of the total pulse area and accounts for 17 per cent of the pulse production of the country. Redgram is cultivated over an area of 4.7 million ha with 4.3 million tonnes. The national productivity is 914 kg ha<sup>-1</sup>. In Karnataka total area under redgram is about 1.63 million ha and production 1.27 million tonnes which is nearly one fourth of total redgram production in our country (Anonymous, 2021). In order to elucidate exhaustive information on the effect of natural farming in comparison to UAS-B recommended package of practices, organic farming and farmers method of cultivation of redgram this study has been planned.

## MATERIAL AND METHODS

Field experiment was conducted during 2022-23 and 2023-24 at organic farming research and demonstration block of Research Institute on Organic Farming (RIOF), Gandhi Krishi Vignan Kendra (GKVK), University of Agricultural Sciences, Bangalore. It is situated at Eastern Dry Zone of Karnataka at 13° 09' North latitude, 77 ° 57' East longitude and at an altitude of 924 m above mean sea level (MSL). The soil of the experimental site was red sandy clay loam grouped under the class of *Alfisols*. Composite soil samples from 0-15 cm depth were collected from the experimental plot before the imposition of treatments and they were analyzed for physical, chemical and biological properties. The values obtained along with the methods employed for their estimation are presented in Table 1. The soil of experimental site was generally neutral in reaction (pH 6.42), medium in available nitrogen (291.2 kg N ha<sup>-1</sup>), medium in available phosphorous (26.24 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>) and medium in available potassium (228.6 kg K<sub>2</sub>O ha<sup>-1</sup>). The organic carbon content of the experimental site was medium (0.64 %).

In order to elucidate exhaustive information on the effect of natural farming in comparison to recommended package of practices, organic production systems and farmers practice of cultivation of redgram this study has been planned. The experiment was conducted with seven treatments and 5 replications. Seven treatments includes, T<sub>1</sub>: Absolute control, T<sub>2</sub>: Organic production system, T<sub>3</sub>: Natural farming practice, T<sub>4</sub>: Natural farming practices + FYM on N equivalent basis, T<sub>5</sub>: Combination of organic farming and natural farming practices, T<sub>6</sub>: Farmers practice, T<sub>7</sub>: Recommended package of practices of UAS, GKVK, Bengaluru. The treatment details are, T<sub>1</sub>: Only sowing of seeds and all other inputs and practices are nil. T<sub>2</sub>: Seed treatment with *Rhizobium*, FYM (75%) + vermicompost (25%) applied based on N equivalent (25 kg N ha<sup>-1</sup>), weeding at 30 DAS, straw mulching (4 t ha<sup>-1</sup>) and need based plant protection using organic materials. T<sub>3</sub>: *ghanajeevamrutha* application at 1000

kg ha<sup>-1</sup>, seed treatment with *beejamrutha*, application of *jeevamrutha* at 15 days interval at 500 liters ha<sup>-1</sup> at 15, 30, 45, 60, 75, 105, 120, 135 and 150 DAS and straw mulching (4 t ha<sup>-1</sup>). Need based plant protection measures using preparations like *neemastra*, *agniastra*, *shuntiastra* etc., (Note : natural farming protocol as given by Shri. Subhash Palekar). T<sub>4</sub>: Seed treatment with *Rhizobium*, FYM applied based on N equivalent (25 kg N ha<sup>-1</sup>), application of *jeevamrutha* at 15 days interval at 500 liters ha<sup>-1</sup> at 15, 30, 45, 60, 75, 105, 120, 135 and 150 DAS and straw mulching (4 t ha<sup>-1</sup>). T<sub>5</sub>: Seed treatment with *beejamrutha* followed by *Rhizobium*, *ghanajeevamrutha* application at 1000 kg ha<sup>-1</sup>, FYM (75%) + vermicompost (25%) applied based on N equivalent (25 kg N ha<sup>-1</sup>) Application of *jeevamrutha* at every 15 days interval at 500 liters ha<sup>-1</sup> at 15, 30, 45, 60, 75, 105, 120, 135 and 150 DAS and Straw mulching (4 t ha<sup>-1</sup>). Spray of neem oil 5 per cent, *neemastra*, *agniastra*, *shuntiastra* and sour butter milk. T<sub>6</sub>: Treatment is based on operations carried out by the farmers in their field, FYM applied at 5 t ha<sup>-1</sup>, 2.5 bags of DAP and two hand weedings at 20 and 40 DAS. T<sub>7</sub>: Seed treatment with *Rhizobium* FYM application at 7.5 t ha<sup>-1</sup>. NPK (25:50:25 kg ha<sup>-1</sup>), spraying of pre-emergence herbicide (pendimethalin 30% E.C @ 1000 ml ha<sup>-1</sup>) fb one hand weeding at 30 DAS for redgram.

Redgram variety BR4-4 seeds sown with recommended seed rate of 15 kg ha<sup>-1</sup> at a spacing of 60x15 cm on during *kharif* 2023 and 2024. Bold and healthy seeds of red gram (BRG-4) was selected for sowing. The plant population was maintained by gap-filling one week after sowing. The thinning attended 20 DAS to maintain a uniform plant population. For Biometric observations, five plants from each plot were randomly selected and labelled for recording observations of plant height (cm) and number of leaves per plant at different growth stages viz. 30, 60, 90, 120 DAS and at harvest. Plant samples for dry matter studies were collected at 30, 60, 90, 120 DAS and at harvest. At each sampling, five plants were uprooted randomly from the rows in each treatment and partitioned into

leaf, stem, petiole and reproductive parts. These samples were oven dried at 70 °C in hot air oven for 72 hours till a constant weight. The leaf area was worked out by disc method on dry weight basis at 30, 60, 90, 120 DAS and at harvest as per the procedure suggested by Vivekanandan *et al.* (1972).

## RESULTS AND DISCUSSION

### The Effect of Natural Farming System on Growth Parameters of Redgram in comparison to Conventional and Organic Production Systems

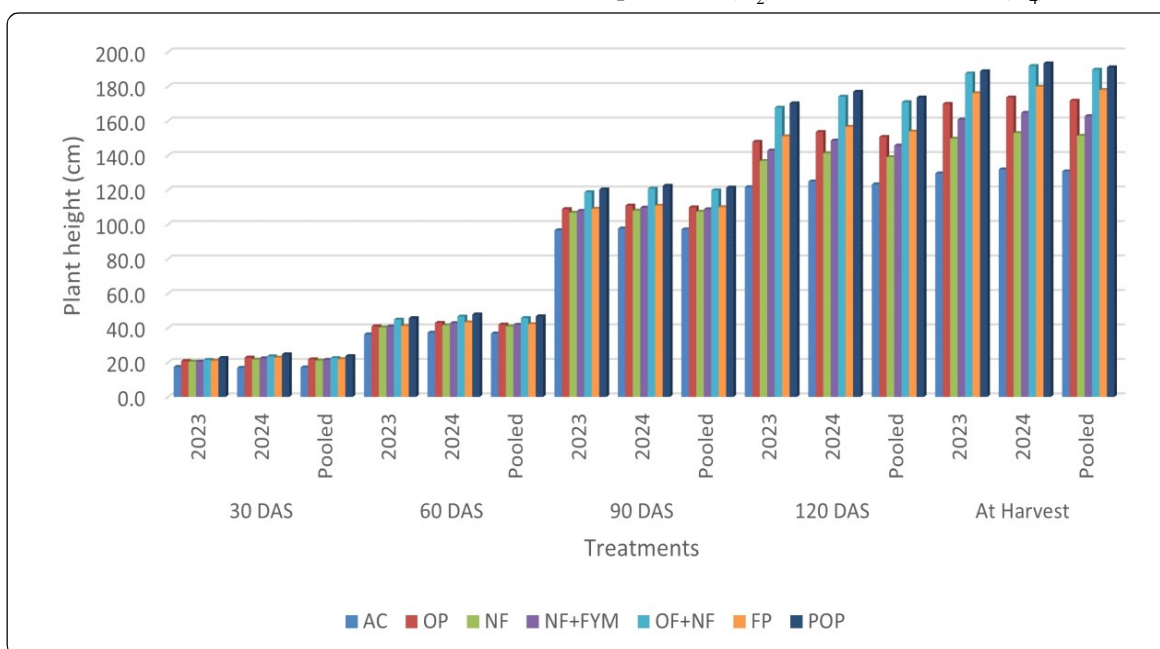
#### Plant Height (cm)

The data pertaining to plant height of redgram as influenced by different farming practices is presented in Table 1 and Fig.1. It is evident from the data that, the pooled plant height in both the years was significantly influenced by different farming practices at all the crop growth stages.

The pooled data clearly revealed that among the different farming practices, UAS Bangalore recommended package of practices (T<sub>7</sub>) recorded

significantly taller plants (23.65, 46.76, 121.36, 173.63 and 191.16 cm at 30, 60, 90, 120 DAS and at harvest, respectively) as compared to other farming practices. However, T<sub>5</sub> i.e., combination of organic farming and natural farming (22.48, 45.72, 119.76, 170.93 and 189.77 cm, respectively) remained on par with UAS Bangalore recommended package of practices (T<sub>7</sub>). While, farmers practice (T<sub>6</sub>) (21.89, 42.17, 110.02, 153.90 and 178.02 cm, respectively) treatment was followed by organic production system (T<sub>2</sub>) which remained statistically at par with natural farming + FYM (T<sub>4</sub>) and the lowest plant height at all the stages was recorded in absolute control (T<sub>1</sub>) (17.10, 36.77, 97.13, 123.29 and 130.79 cm, respectively). This might be due to lower weed intensification, more availability of nutrients and favourable microbial activities in T<sub>7</sub>. The nutrients might have helped in the increase of cell division and elongation of leaves, resulting in higher plant height.

The natural farming treatment (T<sub>3</sub>) recorded redgram plant height (21.04, 40.88, 107.4, 139.0 and 151.4 cm, respectively) but was on par with organic farming practice (T<sub>2</sub>) and NF + FYM (T<sub>4</sub>) Aravind *et al.*



T<sub>1</sub>: Absolute control, T<sub>2</sub>: Organic production system, T<sub>3</sub>: Natural farming practice, T<sub>4</sub>: Natural farming practices + FYM on N equivalent basis, T<sub>5</sub>: Combination of organic farming and natural farming practices, T<sub>6</sub>: Farmers practice and T<sub>7</sub>: Recommended package of practices of UAS, GKVK, Bengaluru

Fig. 1 : Effect of natural farming system on plant height (cm) of redgram in comparison to other production systems

**TABLE 1**  
**Effect of natural farming system on plant height (cm) of redgram in comparison to other production systems**

Treatment	30 DAS			60 DAS			90 DAS			120 DAS			At Harvest		
	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled
	T <sub>1</sub> - AC	17.34	16.86	17.10	36.28	37.27	36.77	96.63	97.62	97.13	121.63	124.94	123.29	129.63	131.95
T <sub>2</sub> OP	20.81	22.81	21.81	40.95	42.95	41.95	108.95	110.95	109.95	147.95	153.64	150.79	169.95	173.64	171.79
T <sub>3</sub> - NF	20.44	21.65	21.04	40.27	41.48	40.88	106.83	108.04	107.44	136.83	141.25	139.04	149.83	153.04	151.44
T <sub>4</sub> - NF+FYM	20.49	22.39	21.44	40.86	42.76	41.81	107.86	109.76	108.81	142.86	148.66	145.76	160.86	164.76	162.81
T <sub>5</sub> - OF+NF	21.44	23.52	22.48	44.84	46.61	45.72	118.72	120.80	119.76	167.72	174.13	170.93	187.60	191.93	189.77
T <sub>6</sub> - FP	21.00	22.77	21.89	41.13	43.21	42.17	109.13	110.90	110.02	151.13	156.67	153.90	176.13	179.90	178.02
T <sub>7</sub> - POP	22.58	24.72	23.65	45.69	47.83	46.76	120.29	122.43	121.36	170.29	176.98	173.63	188.89	193.44	191.16
S.Em±	0.49	0.66	0.42	1.34	1.45	0.95	3.53	3.62	2.43	3.53	3.91	2.54	4.26	4.30	2.91
CD (p=0.05)	1.44	1.92	1.18	3.91	4.24	2.70	10.29	10.58	6.88	10.29	11.42	7.17	12.43	12.54	8.22

T<sub>1</sub>: Absolute control, T<sub>2</sub>: Organic production system, T<sub>3</sub>: Natural farming practice, T<sub>4</sub>: Natural farming practices + FYM on N equivalent basis, T<sub>5</sub>: Combination of organic farming and natural farming practices, T<sub>6</sub>: Farmers practice and T<sub>7</sub>: Recommended package of practices of UAS, GKVK, Bengaluru

(2006); Vedpathak *et al.* (2015) and Tomar *et al.* (2017) also reported the beneficial effect of FYM along with NPK application on plant height in maize. Ravi *et al.* (2012) found that liquid manures like *Jeevamrutha* and *Panchagavya* along with organic and inorganic sources had contributed for increased plant height in maize but Sudhanshu *et al.* (2015) reported that application of *Jeevamrutha* alone showed poor plant height in rice. These results are also supported by Vinay *et al.* (2021).

### Number of Leaves

The data pertaining to number of leaves as influenced by different farming practices presented in Table 3, revealed that, the pooled number of leaves in both the years is significantly influenced by different farming practices at all the crop growth stages.

The pooled data clearly revealed that among the different farming practices, UAS Bangalore recommended package of practices (T<sub>7</sub>) recorded significantly more number of leaves per plant (4.63, 37.16, 90.44, 135.16 and 123.66 at 30, 60, 90, 120 DAS and at harvest, respectively) as compared to other farming practices. However, T<sub>5</sub> *i.e.*, combination of organic farming and natural farming (3.98, 36.21, 88.22, 133.17 and 121.83 respectively) remained on par with UAS Bangalore recommended package of practices (T<sub>7</sub>). While, T<sub>6</sub> *i.e.*, farmers practice (3.42, 32.22, 78.66, 121.38 and 111.00 respectively) treatment was followed by organic production system (T<sub>2</sub>) which remained statistically at par with natural farming + FYM (T<sub>4</sub>) and the lowest number of leaves at all the stages was recorded in absolute control (T<sub>1</sub>) (2.42, 26.64, 65.81, 105.42 and 96.31 respectively).

The natural farming treatment (T<sub>3</sub>) recorded number of leaves of redgram (3.09, 31.08, 76.23, 118.3 and 108.19 respectively) but was on par with organic farming practice (T<sub>2</sub>) and NF+FYM (T<sub>4</sub>)

The superior performance of the UAS (B) package of practices may be attributed to the enhanced availability of major nutrients in readily accessible

**TABLE 2**  
**Effect of natural farming system on number of leaves of redgram in comparison to other production systems**

Treatment	30 DAS			60 DAS			90 DAS			120 DAS			At Harvest		
	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled
	T <sub>1</sub> -AC	2.46	2.37	2.42	25.48	27.80	26.64	63.69	67.92	65.81	102.76	108.08	105.42	94.20	98.42
T <sub>2</sub> OP	3.09	4.01	3.55	30.15	33.84	31.99	75.37	80.96	78.16	117.78	124.47	121.12	107.96	113.56	110.76
T <sub>3</sub> -NF	3.03	3.16	3.09	29.47	32.68	31.08	73.68	78.79	76.23	115.24	121.45	118.34	105.64	110.75	108.19
T <sub>4</sub> -NF+FYM	3.09	3.91	3.50	30.06	33.96	32.01	75.16	80.96	78.06	116.48	123.38	119.93	106.77	112.57	109.67
T <sub>5</sub> -OF+NF	3.48	4.48	3.98	34.04	38.37	36.21	85.10	91.33	88.22	129.50	136.83	133.17	118.71	124.94	121.83
T <sub>6</sub> -FP	3.11	3.73	3.42	30.33	34.10	32.22	75.83	81.50	78.66	118.00	124.77	121.38	108.17	113.83	111.00
T <sub>7</sub> -POP	3.57	5.68	4.63	34.89	39.44	37.16	87.22	93.67	90.44	131.38	138.93	135.16	120.44	126.89	123.66
S.Em±	0.14	0.10	0.09	1.34	1.53	0.98	3.35	3.48	2.32	4.24	4.49	2.97	3.89	4.14	2.73
CD(p=0.05)	0.41	0.31	0.25	3.91	4.46	2.77	9.77	10.17	6.57	12.38	13.10	8.39	11.35	12.08	7.72

T<sub>1</sub>: Absolute control, T<sub>2</sub>: Organic production system, T<sub>3</sub>: Natural farming practice, T<sub>4</sub>: Natural farming practices + FYM on N equivalent basis, T<sub>5</sub>: Combination of organic farming and natural farming practices, T<sub>6</sub>: Farmers practice and T<sub>7</sub>: Recommended package of practices of UAS, GKVK, Bengaluru

forms, particularly nitrogen, which plays a pivotal role in promoting vegetative growth and biomass accumulation. Adequate nitrogen supply facilitates increased chlorophyll synthesis, photosynthetic activity, and cell division, thereby contributing to production of more number of leaves per plant. These findings are in conformity with the reports of Thakur *et al.* (1997), Ravi *et al.* (2012), Vidya & Channappagouda (2015), Tomar *et al.* (2017) and Vinay *et al.* (2021).

### Leaf Area (dm<sup>2</sup> plant<sup>-1</sup>)

The pooled data in the Table 3. contains data of leaf area as influenced by different farming methods. The statistics strongly show that differing farming practices at all crop growth phases have a considerable influence on the pooled leaf area in both years. In redgram the leaf area increased linearly as the growth stages advanced and it reached a maximum at 120 DAS and thereafter it declined towards maturity.

The pooled data clearly revealed that among the different farming practices, UAS Bangalore recommended package of practices (T<sub>7</sub>) recorded significantly more leaf area (6.82, 19.57, 38.16, 53.60 and 30.26 dm<sup>2</sup> plant<sup>-1</sup> at 30, 60, 90, 120 DAS and at harvest, respectively) as compared to other farming practices. However, T<sub>5</sub> *i.e.*, combination of organic farming and natural farming (6.12, 18.59, 37.16, 52.59 and 29.15 dm<sup>2</sup> plant<sup>-1</sup> respectively) remained on par with UAS Bangalore recommended package of practices (T<sub>7</sub>). While, farmers practice (T<sub>6</sub>) (5.62, 17.75, 33.08, 47.20 and 24.79 dm<sup>2</sup> plant<sup>-1</sup> respectively) treatment was followed by organic production system (T<sub>2</sub>) which remained statistically at par with natural farming + FYM (T<sub>4</sub>) and the lowest leaf area at all the stages was recorded in absolute control (T<sub>1</sub>) (4.35, 15.26, 24.81, 40.88 and 16.87 dm<sup>2</sup> plant<sup>-1</sup> respectively). This could be due to higher nutrient availability during the entire growth period in UAS (B) package of practice than either organic or natural farming practices. These results are supported by Vinay *et al.* (2021).

**TABLE 3**  
**Effect of natural farming system on leaf area (dm<sup>2</sup> plant<sup>-1</sup>) of redgram in comparison to other production systems**

Treatment	30 DAS			60 DAS			90 DAS			120 DAS			At Harvest		
	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled
	T <sub>1</sub> - AC	4.37	4.33	4.35	13.94	16.58	15.26	23.65	25.97	24.81	39.72	42.04	40.88	16.46	17.28
T <sub>2</sub> OP	4.84	6.69	5.77	15.71	19.40	17.55	31.42	35.12	33.27	44.59	48.29	46.44	24.52	25.37	24.95
T <sub>3</sub> - NF	4.78	5.03	4.90	15.46	18.32	16.89	33.09	36.30	34.70	41.82	45.03	43.43	25.70	26.53	26.12
T <sub>4</sub> - NF+FYM	4.84	6.48	5.66	15.67	19.27	17.47	33.26	37.16	35.21	43.92	47.82	45.87	26.56	27.40	26.98
T <sub>5</sub> - OF+NF	5.11	7.12	6.12	16.70	20.48	18.59	35.00	39.33	37.16	50.42	54.75	52.59	28.73	29.58	29.15
T <sub>6</sub> - FP	4.86	6.37	5.62	15.77	19.73	17.75	31.20	34.97	33.08	45.31	49.08	47.20	24.37	25.21	24.79
T <sub>7</sub> - POP	5.32	8.32	6.82	17.46	21.68	19.57	35.89	40.44	38.16	51.32	55.87	53.60	29.84	30.69	30.26
S.Em±	0.14	0.17	0.12	0.52	0.49	0.35	1.46	1.72	1.09	1.96	2.09	1.38	1.66	1.66	1.13
CD (p=0.05)	0.41	0.49	0.33	1.51	1.42	0.98	4.26	5.02	3.07	5.72	6.10	3.90	4.84	4.86	3.19

T<sub>1</sub>: Absolute control, T<sub>2</sub>: Organic production system, T<sub>3</sub>: Natural farming practice, T<sub>4</sub>: Natural farming practices + FYM on N equivalent basis, T<sub>5</sub>: Combination of organic farming and natural farming practices, T<sub>6</sub>: Farmers practice and T<sub>7</sub>: Recommended package of practices of UAS, GKVK, Bengaluru

The natural farming treatment (T<sub>3</sub>) recorded leaf area of redgram (4.90, 16.89, 34.70, 43.43 and 26.12 dm<sup>2</sup> plant<sup>-1</sup> respectively) but was on par with organic farming practice (T<sub>2</sub>) and NF+FYM (T<sub>4</sub>).

### Leaf Dry Matter (g plant<sup>-1</sup>)

Table 4, displays the information about leaf dry matter production influenced by various farming methods. The statistics clearly show that varied farming practices at every stage of crop growth have a considerable impact on the pooled leaf dry matter production in both years.

The pooled data clearly revealed that among the different farming practices, UAS Bangalore recommended package of practices (T<sub>7</sub>) recorded significantly more leaf dry matter production (1.05, 4.65, 11.83, 12.11 and 5.67 g plant<sup>-1</sup> at 30, 60, 90, 120 DAS and at harvest, respectively) as compared to other farming practices. However, T<sub>5</sub> i.e., combination of organic farming and natural farming (1.01, 4.56, 11.49, 11.95 and 6.56 g plant<sup>-1</sup> respectively) remained on par with UAS Bangalore recommended package of practices (T<sub>7</sub>). While, T<sub>6</sub> i.e., farmers practice (0.96, 4.07, 10.49, 10.98 and 6.18 g plant<sup>-1</sup> respectively) treatment was followed by organic production system (T<sub>2</sub>) which remained statistically at par with natural farming + FYM (T<sub>4</sub>) and the lowest leaf dry matter produced at all the stages was recorded in absolute control (T<sub>1</sub>) (0.70, 3.67, 8.42, 9.68 and 5.67 g plant<sup>-1</sup> respectively).

The natural farming treatment (T<sub>3</sub>) recorded leaf dry matter production of redgram (0.83, 4.07, 9.52, 10.73 and 6.07 g plant<sup>-1</sup> respectively) but was on par with organic farming practice (T<sub>2</sub>) and NF+FYM (T<sub>4</sub>).

### Stem Dry Matter (g plant<sup>-1</sup>)

The data with respect to stem dry matter production as influenced by different farming practices is presented in Table 5. It is evident from the data that, the pooled stem dry matter production in both the years is significantly influenced by different farming practices at all the crop growth stages.

**TABLE 4**  
**Effect of natural farming system on leaf dry matter (g plant<sup>-1</sup>) production of redgram in comparison to other production systems**

Treatment	30 DAS			60 DAS			90 DAS			120 DAS			At Harvest		
	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled
	T <sub>1</sub> - AC	0.66	0.74	0.70	3.63	3.70	3.67	8.39	8.45	8.42	9.64	9.72	9.68	5.63	5.70
T <sub>2</sub> OP	0.87	1.02	0.94	4.09	4.13	4.11	10.20	10.29	10.25	10.89	11.05	10.97	6.09	6.25	6.17
T <sub>3</sub> - NF	0.78	0.88	0.83	4.03	4.12	4.07	9.44	9.60	9.52	10.68	10.78	10.73	6.03	6.12	6.07
T <sub>4</sub> - NF+FYM	0.85	0.99	0.92	4.09	4.12	4.10	9.85	9.95	9.90	10.79	10.93	10.86	6.09	6.23	6.16
T <sub>5</sub> - OF+NF	0.93	1.09	1.01	4.48	4.64	4.56	11.57	11.41	11.49	11.87	12.03	11.95	6.48	6.64	6.56
T <sub>6</sub> - FP	0.90	1.03	0.96	4.11	4.03	4.07	10.42	10.56	10.49	10.91	11.05	10.98	6.11	6.25	6.18
T <sub>7</sub> - POP	0.96	1.13	1.05	4.57	4.73	4.65	11.74	11.91	11.83	12.03	12.19	12.11	6.57	6.73	6.65
S.Em±	0.02	0.03	0.02	0.13	0.12	0.09	0.24	0.24	0.17	0.35	0.36	0.24	0.13	0.14	0.09
CD (p=0.05)	0.06	0.10	0.06	0.39	0.35	0.25	0.71	0.70	0.47	1.03	1.05	0.69	0.39	0.41	0.26

T<sub>1</sub>: Absolute control, T<sub>2</sub>: Organic production system, T<sub>3</sub>: Natural farming practice, T<sub>4</sub>: Natural farming practices + FYM on N equivalent basis, T<sub>5</sub>: Combination of organic farming and natural farming practices, T<sub>6</sub>: Farmers practice and T<sub>7</sub>: Recommended package of practices of UAS, GKVK, Bengaluru

The pooled data clearly revealed that among the different farming practices, UAS Bangalore recommended package of practices (T<sub>7</sub>) recorded significantly more stem dry matter production (1.16, 6.11, 24.57, 37.67 and 58.60 g plant<sup>-1</sup> at 30, 60, 90, 120 DAS and at harvest, respectively) as compared to other farming practices. However, T<sub>5</sub> i.e., combination of organic farming and natural farming (1.12, 5.44, 22.91, 35.11 and 57.59 at 30, 60, 90, 120 DAS and at harvest, respectively) remained on par with UAS Bangalore recommended package of practices (T<sub>7</sub>). While, T<sub>6</sub> i.e., farmers practice (1.07, 4.99, 20.38, 33.00 and 52.20 at 30, 60, 90, 120 DAS and at harvest, respectively) treatment was followed by organic production system (T<sub>2</sub>) which remained statistically at par with natural farming + FYM (T<sub>4</sub>) and the lowest stem dry matter production at all the stages was recorded in absolute control (T<sub>1</sub>) (0.80, 4.21, 15.27, 27.01 and 45.88 at 30, 60, 90, 120 DAS and at harvest, respectively).

The natural farming treatment (T<sub>3</sub>) recorded stem dry matter production of redgram (0.94, 4.71, 21.29, 29.23 and 48.43 g plant<sup>-1</sup> respectively) but was on par with organic farming practice (T<sub>2</sub>) and NF+FYM (T<sub>4</sub>).

**Total Dry Matter Production (g plant<sup>-1</sup>)**

The data of total dry matter production as influenced by different farming practices is presented in Table 6. It is evident from the table that, the pooled total dry matter production in both the years is significantly influenced by different farming practices at all the crop growth stages.

Higher dry matter production per unit area is the prerequisite for higher yield. The amount of dry matter produced depends on the photosynthetic apparatus in the plant. Data recorded on dry matter production at different intervals during crop growth are presented in Table 4, 5 and 6 and Fig. 2

The data of total dry matter production as influenced by different farming practices is presented in Table 06. It is evident from the data that, the pooled total dry matter production in both the years is significantly

**TABLE 5**  
**Effect of natural farming system on stem dry matter production (g plant<sup>-1</sup>) of redgram in comparison to other production systems**

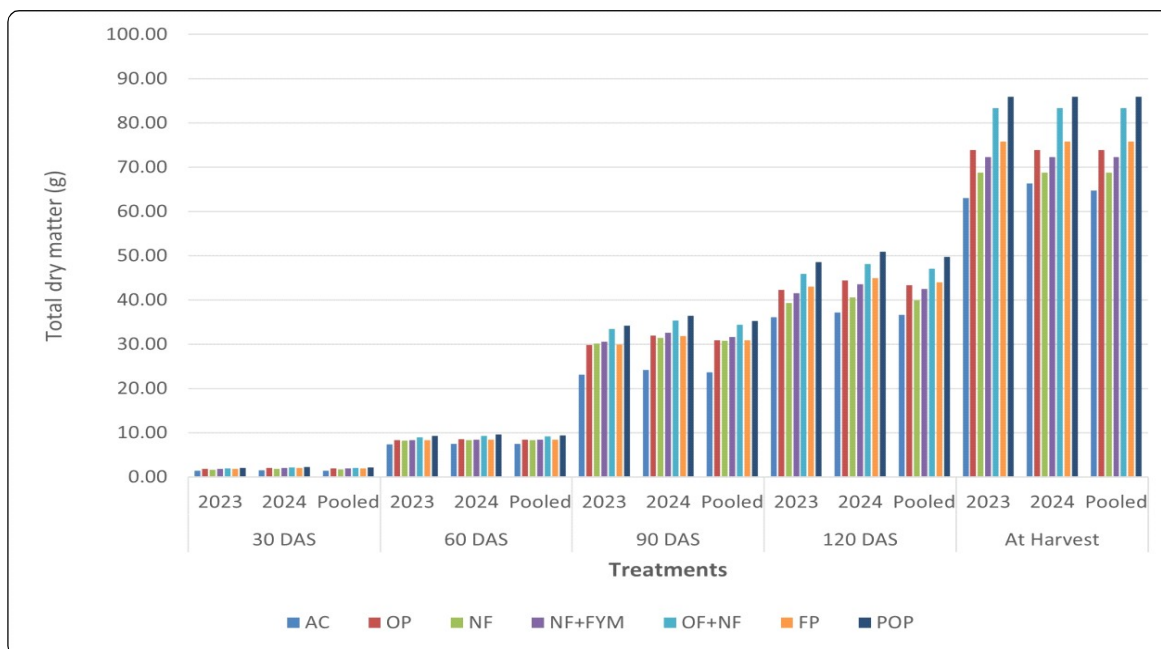
Treatment	30 DAS			60 DAS			90 DAS			120 DAS			At Harvest		
	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled
	T <sub>1</sub> -AC	0.76	0.83	0.80	3.77	4.65	4.21	14.78	15.77	15.27	26.52	27.51	27.01	44.72	47.04
T <sub>2</sub> OP	0.98	1.13	1.05	4.24	6.00	5.12	19.64	21.64	20.64	31.39	33.39	32.39	49.59	53.29	51.44
T <sub>3</sub> -NF	0.89	0.99	0.94	4.18	5.24	4.71	20.68	21.89	21.29	28.62	29.83	29.23	46.82	50.03	48.43
T <sub>4</sub> -NF+FYM	0.96	1.10	1.03	4.24	5.90	5.07	20.79	22.69	21.74	30.72	32.62	31.67	48.92	52.82	50.87
T <sub>5</sub> -OF+NF	1.04	1.20	1.12	4.51	6.37	5.44	21.87	23.95	22.91	34.07	36.15	35.11	55.42	59.75	57.59
T <sub>6</sub> -FP	1.01	1.14	1.07	4.26	5.71	4.99	19.50	21.27	20.38	32.11	33.88	33.00	50.31	54.08	52.20
T <sub>7</sub> -POP	1.07	1.24	1.16	4.72	7.50	6.11	22.43	24.57	23.50	36.60	38.74	37.67	56.32	60.87	58.60
S.Em±	0.02	0.04	0.02	0.14	0.17	0.18	0.91	1.08	0.68	1.34	1.44	0.95	1.96	2.09	1.38
CD (p=0.05)	0.06	0.10	0.06	0.41	0.51	0.50	2.66	3.14	1.93	3.92	4.21	2.69	5.72	6.10	3.90

T<sub>1</sub>: Absolute control, T<sub>2</sub>: Organic production system, T<sub>3</sub>: Natural farming practice, T<sub>4</sub>: Natural farming practices + FYM on N equivalent basis, T<sub>5</sub>: Combination of organic farming and natural farming practices, T<sub>6</sub>: Farmers practice and T<sub>7</sub>: Recommended package of practices of UAS, GKVK, Bengaluru

**TABLE 6**  
**Effect of natural farming system on total dry matter production (g plant<sup>-1</sup>) of redgram in comparison to other production systems**

Treatment	30 DAS			60 DAS			90 DAS			120 DAS			At Harvest		
	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled	2023	2024	Pooled
	T <sub>1</sub> -AC	1.42	1.57	1.50	7.40	8.36	7.88	23.17	24.22	23.69	36.16	37.23	36.70	50.35	52.75
T <sub>2</sub> OP	1.84	2.15	1.99	8.34	10.13	9.23	29.84	31.93	30.89	42.29	44.44	43.37	55.69	59.54	57.61
T <sub>3</sub> -NF	1.68	1.86	1.77	8.20	9.36	8.78	30.12	31.49	30.80	39.30	40.61	39.96	52.85	56.15	54.50
T <sub>4</sub> -NF+FYM	1.80	2.10	1.95	8.32	10.02	9.17	30.64	32.63	31.64	41.51	43.56	42.53	55.01	59.06	57.03
T <sub>5</sub> -OF+NF	1.98	2.30	2.14	9.00	11.02	10.01	33.44	35.36	34.40	45.94	48.18	47.06	61.90	66.39	64.15
T <sub>6</sub> -FP	1.90	2.17	2.04	8.38	9.74	9.06	29.92	31.83	30.87	43.03	44.93	43.98	56.43	60.33	58.38
T <sub>7</sub> -POP	2.04	2.36	2.20	9.29	12.24	10.76	34.17	36.48	35.33	48.63	50.93	49.78	62.89	67.60	65.25
S.Em±	0.04	0.07	0.05	0.27	0.24	0.24	1.04	1.19	1.10	1.56	1.68	1.61	2.00	2.15	2.06
CD(p=0.05)	0.12	0.20	0.14	0.79	0.70	0.69	3.03	3.49	3.20	4.56	4.89	4.69	5.85	6.26	6.00

T<sub>1</sub>: Absolute control, T<sub>2</sub>: Organic production system, T<sub>3</sub>: Natural farming practice, T<sub>4</sub>: Natural farming practices + FYM on N equivalent basis, T<sub>5</sub>: Combination of organic farming and natural farming practices, T<sub>6</sub>: Farmers practice and T<sub>7</sub>: Recommended package of practices of UAS, GKVK, Bengaluru



T<sub>1</sub>: Absolute control, T<sub>2</sub>: Organic production system, T<sub>3</sub>: Natural farming practice, T<sub>4</sub>: Natural farming practices + FYM on N equivalent basis, T<sub>5</sub>: Combination of organic farming and natural farming practices, T<sub>6</sub>: Farmers practice and T<sub>7</sub>: Recommended package of practices of UAS, GKVK, Bengaluru

Fig. 2 : Effect of natural farming system on total dry matter production (g plant<sup>-1</sup>) of redgram in comparison to other production systems

influenced by different farming practices at all the crop growth stages.

Higher dry matter production per unit area is the pre-requisite for higher yield. The amount of dry matter produced depends on the photosynthetic apparatus in the plant. Data recorded on dry matter production at different intervals during crop growth are presented in Table 4, 5 and 6 and Fig. 1

The pooled data clearly revealed that among the different farming practices, UAS Bangalore recommended package of practices (T<sub>7</sub>) recorded significantly more total dry matter production (2.20, 10.76, 35.33, 49.78 and 65.25 g plant<sup>-1</sup> at 30, 60, 90, 120 DAS and at harvest, respectively) as compared to other farming practices. However, T<sub>5</sub> *i.e.*, combination of organic farming and natural farming (2.14, 10.01, 34.40, 47.06 and 64.15 g plant<sup>-1</sup> at 30, 60, 90, 120 DAS and at harvest, respectively) remained on par with UAS Bangalore recommended package of practices (T<sub>7</sub>). While, T<sub>6</sub> *i.e.*, farmers practice (2.04, 9.06, 30.87, 43.98 and

58.38 g plant<sup>-1</sup> at 30, 60, 90, 120 DAS and at harvest, respectively) treatment was followed by organic production system (T<sub>2</sub>) which remained statistically at par with natural farming + FYM (T<sub>4</sub>) and the lowest total dry matter production at all the stages was recorded in absolute control (T<sub>1</sub>) (1.50, 7.88, 23.69, 36.70 and 57.03 g plant<sup>-1</sup> at 30, 60, 90, 120 DAS and at harvest, respectively). This could be due to higher nutrient availability during the entire growth period in UAS(B) package of practices than either organic or natural farming practices. The findings of the present study are consistent with those of Saini *et al.* (2006) and Shivanandagowda *et al.* (2023).

The natural farming treatment (T<sub>3</sub>) recorded total dry matter production of redgram (1.77, 8.78, 30.80, 39.96 and 54.50 g plant<sup>-1</sup> respectively) but was on par with organic farming practice (T<sub>2</sub>) and NF+FYM (T<sub>4</sub>).

The TDM production and its accumulation in different parts of plants were achieved only with the development of sound growth attributes *viz.*, plant height, number of leaves, number of branches and

leaf area. These parameters were significantly higher in UAS(B) package of practice as compared to organic and natural farming practices. The findings of the present study are consistent with those of Saini *et al.* (2006), Sharma *et al.* (2009), Kuri & Chandrashekar (2015).

UAS(B) package of practice recorded significantly higher plant height (191.16 cm), number of leaves (129.69), leaf area (30.26), total dry matter production, (62.55 g), number of branches (18.97) at harvest stage and same trend were observed at all the growth stages. UAS Bangalore recommended package of practices ( $T_7$ ) recorded significantly more total dry matter production (2.20, 10.76, 35.33, 49.78 and 65.25 g plant<sup>-1</sup> at 30, 60, 90, 120 DAS and at harvest, respectively) as compared to other farming practices. Overall, the UASB POP and the integrated approach combining natural farming and organic farming practices demonstrated superior performance in terms of growth and biomass accumulation, indicating their effectiveness under the conditions of the present study.

#### REFERENCES

- ANONYMOUS, 2021, Area, production and average yield, Directorate of Economics and Statistics, Department of Agriculture and Cooperation report, New Delhi, available in the website: <http://www.agricoop.nic.in>
- ARAVIND, V., NEPALIA, V. AND KANTHALIYA, P. C., 2006, Effect of integrated nutrient supply on growth, yield and nutrient uptake by maize (*Zea mays*)-wheat (*Triticum aestivum*) cropping system. *Indian J. Agron.*, **51** (1) : 3 - 6.
- BANSILAL, A. AND NAIKA, K. V., 2019, Management efficiency of redgram growers in North-Eastern Karnataka. *Mysore J. Agric. Sci.*, **53** (2) : 82 - 90.
- DEVAKUMAR, N., LAVANYA, G. AND RAO, G. G. E., 2018, Influence of jeevamrutha and panchagavya on beneficial soil microbial population and yield of organic field bean (*Dolichos lablab L.*), *Mysore J. Agric. Sci.*, **52** (4) : 790 - 795.
- KURI, S. AND CHANDRASHEKARA, C. P., 2015, Growth indices and yield of sugarcane genotypes under organic, inorganic and integrated nutrient management practices. *Karnataka J. Agric. Sci.*, **28** (3) : 322 - 326.
- PALEKAR, S., 2006, *Shoonya Bandovalada Naisargika Krushi*, Published by Swamy Anand, Agri Prakashana, Bangalore, pp. : 145 - 158.
- RAVI, N., BASAVARAJAPPA, R., CHANDRASHEKAR, P., HARLAPURM. S. I., HOSAMANI, H. AND MANJUNATHA, M. V., 2012, Effect of integrated nutrient management on growth and yield of quality protein maize. *Karnataka J. Agric. Sci.*, **25** (3) : 395 - 396.
- SAINI, S. K., RAJESH, A., VIJENDAR SINGH. AND SINHA, S. K., 2006, Effect of fly ash, press mud cake and phosphorus solubilising bacteria (PSB) on yield, growth and quality of sugarcane. *Indian Sugar*, **56** : 25 - 28.
- SHARMA, B. L., ANIL, K., MISHRA, SRIVASTAVA, P. N., SINGH, D. N. AND SINGH, S. B., 2009, Enriched press mud cake with phosphorus, potassium and biofertilizers on sugarcane. *Coop. Sugar*, **40** (5) : 43 - 47.
- SHIVANANDAGOUDA, 2023, Productivity and economics of seasonal and *adsali* sugarcane based intercropping systems under natural, organic and conventional farming practices. *Ph.D. Thesis*, Univ. Agric. Sci. Dharwad, Karnataka.
- SMITH, J., YELURIPATI, J., SMITH, P. AND NAYAK, D. R., 2020, Potential yield challenges to scale-up of zero budget natural farming. *Nat. Sustain.*, **3** (3) : 247 - 252.
- SUDHANSHU S. K., MUKUND, J., BHASKAR, S., GOPINATH, K. A. AND KUMAR, M. K., 2015, Evaluation of jeevamrutha as a bio-resource for nutrient management in aerobic rice. *Int. J. Stress Manag.*, **6** (1) : 155 - 160.
- THAKUR, D. R., OM PRAKASH, KHARWARA, P. C. AND BHALLA, S. K., 1997, Effect of nitrogen and plant spacing on growth, yield and economics of baby corn (*Zea mays*). *Indian J. Agron.*, **42** (3) : 479 - 483.
- TOMAR, S. S., ADESH, S., ASHISH, D., RAHUL, S., NARESH, R. K., VINEET, K., SAURABH, T., ANKIT, S. Y., SIDDHART, N. R. AND BRAJENDRA, P. S., 2017, Effect of integrated nutrient management for sustainable production system of maize (*Zea mays L.*) in indo-gangetic plain zone of India. *Int. J. Chem. Stud.*, **5** (2) : 310 - 316.

- VEDPATHAK, M. M. AND CHAVAN, B. L., 2015, Comparative studies on response of maize (*Zea mays*) crop to organic and straight chemical fertilizers. *Int. J. Res. Eng. Appl. Sci.*, **6** (9) : 93 - 98.
- VIDYA, C. V. V. AND CHANNAPPAGOUDA, B. B., 2015, Effect of organics on morphophysiological traits and grain yield of maize (*Zea mays* L.). *Bioscan.*, **10** (1) : 339 - 341.
- VINAY, G., PADMAJA, B., MALLA REDDY, M., JAYASREE, G. AND TRIVENI, S., 2021, Evaluation of natural farming practices on the performance of maize. *Int. J. Ecol. Environ. Sci.*, **2** (3) : 224 - 230.
- VIVEKANANDAN, A. S., GUNASENA, H. P. M. AND SIVANANYAGAM, T., 1972, Statistical evaluation of accuracy of three techniques used in estimation of leaf area of crop plants. *Indian J. Agric. Sci.*, **42** : 847 - 860.