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Effect of foliar application of organic inputs on leaf biomass production and quality of Annual Moringa (*Moringa oleifera* Lam.) var. PKM 1

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Abstract
The effect of foliar application of organic inputs on leaf biomass production of Annual *Moringa* (*Moringa oleifera* Lam.) var. PKM 1 was studied during 2021-2022 at Western Block Farm of Horticultural College and Research Institute, Periyakulam. The Annual *Moringa* variety PKM 1 was transplanted at 1.5 m x 0.5 m spacing. Foliar application of organic inputs *viz*., Sea Weed Extract, Panchagavya, *Moringa* Leaf Extract at different concentrations was given as per the treatment schedule. The experimental plot was laid out in a Randomised Block Design (RBD) with three replications and nine treatments *viz*., T_1: Control (No spray), T_2: Sea Weed Extract (4%), T_3: Panchagavya (3%), T_4: *Moringa* Leaf Extract (5%), T_5: *Moringa* Leaf Extract (10%), T_6: Sea Weed extract (4%) + *Moringa* Leaf Extract (5%), T_7: Sea Weed extract (4%) + *Moringa* Leaf Extract (10%), T_8: Panchagavya (3%) + *Moringa* Leaf Extract (5%), T_9: Panchagavya (3%) + *Moringa* Leaf Extract (10%). These organic inputs were sprayed on foliage of PKM 1 *Moringa* plants. The first spray was on 25 days after transplanting and second spray 25 days after first harvest. Harvesting of Annual *Moringa* leaves was done on 60 days after transplanting leaving 60 cm above the ground level at every 45 days interval on subsequent harvest. Plant growth, leaf biomass yield and quality parameters were recorded in each harvest and the data was statistically analysed. The treatment T_4: *Moringa* Leaf Extract (5%) expressed significant with maximum plant height (149.60 and 183.00 cm), higher stem girth (6.72 and 10.50 cm) and more number of branches per plant (3.13 and 8.00), followed by T_5: *Moringa* Leaf Extract (10%) on first and second harvest. The number of compound leaves per plant, fresh leaf yield per hectare, dry leaf yield per hectare, chlorophyll, ascorbic acid, β-carotene and moisture content were observed maximum in T_5: *Moringa* Leaf Extract (10%), followed by T_4: *Moringa* Leaf Extract (4%) compared to other treatments. The minimum was recorded in control. This study shows improved growth of Annual *Moringa* variety PKM 1 by the foliar application of organic inputs, in terms of better growth, yield and quality of biomass.

Keywords: Annual *Moringa*, organic inputs, foliar application, growth, yield, quality of leaves

1. Introduction
Moringa oleifera Lam. a species of the family "Moringaceae" is extensively grown in several tropical and subtropical regions and has its high nutraceuticals value (Ponnuswami *et al*., 2019) [27]. *Moringa* is one of the most beneficial plants in the world and a potential food source, because of its very nutritious leaf. *Moringa* is one of the major vegetable crops grown by the indigenous peoples of the subcontinent in every backyard for its pods and leaves (Duke, 1978) [8]. There are more than 13 species in the genus *Moringa*, two of which, *Moringa oleifera* and *Moringa concanensis* are grown as vegetables in India. Other names for *Moringa oleifera* are "The Spinach Tree", "Mother's Best Friend", "Miracle Tree", "Horse Radish Tree", "Drumstick Tree", "West Indian Ben", "Murungai (In Tamil)" (Ramachandran *et al*., 1980) [30]. *Moringa* leaves are a major source of nutrients for rural residents (Gupta *et al*., 1989; Lockett *et al*., 2000) [14, 19]. According to majority of reports (Gupta *et al*., 1989; Makkar and Becker, 1996; Freiberger *et al*., 1998) [14, 20, 12], *Moringa* leaves are high in protein and have amino acid composition that is suitable for both human and animal feed. 100 g of *Moringa* leaves have four times the amount of vitamin A contained in 100 g of carrots, four times the amount of calcium in a cup of milk, twice the amount of iron in 100 g of spinach, seven times the amount of vitamin C in 100 g of orange and three times the amount of potassium in 100 g of banana. *Moringa* leaves have protein content that is comparable to that of milk and eggs (Fahey, 2005) [11]. The *Moringa* leaves or leaf powder contain considerable amounts of vitamins A, B, C, calcium, iron and protein, which can be used successfully as a complex diet to nourish young children, pregnant women and nursing mothers as a treatment for malnutrition (Ramachandran *et al*., 1980) [30].

Ben oil extracted from *Moringa* seed kernel is one of the finest machine lubricant as well as in the manufacture of cosmetic products (Tsaknis *et al*., 1999) [35]. *Moringa* leaves, flowers, mature and immature pods are extremely nutritious and as a result of its high nutritional value, it is consumed as vegetables in many regions, including India, Philippines, Hawaith, Pakistan and many regions of Africa (D'souza and Kulkarni, 1993; Anwar and Bhanger, 2003; Anwar *et al*., 2005) [7, 4, 3,]. Morimitsu *et al.* (2000) [22]; Siddhuraju and Becker (2003) [32], recorded that *Moringa oleifera* also has number of medicinal properties. Almost all parts of the plant, including the root, bark, gum, leaf, pods, flowers and seed have been used for various ailments in South Asian traditional medicine for the treatment of inflammation and infectious diseases like cardiovascular, gastrointestinal, haematological disorders.

In order to develop an organic production package of *Moringa* biomass, a study on the effect of organic inputs on the growth and yield of the annual *Moringa* variety PKM 1 was taken up. As the organic inputs hold potential to encourage productivity and fertility while protecting the environment (Suhag, 2016; Youssef, 2016) [33, 39], the research was carried out. A field trial entitled "Effect of foliar application of organic inputs on leaf biomass production and quality of Annual *Moringa* (*Moringa oleifera* Lam.) var. PKM 1 was conducted at Horticultural College and Research Institute, Periyakulam, Theni District, to investigate the effect of foliar application of various organic inputs on growth, yield and quality of *Moringa*.

2. Materials and Methods

The experiment was carried out during December 2021-August 2022 at Field No. 35 of the Western Block Farm (10°1283' N latitude, 77°5998' E longitude) of Horticultural College and Research Institute, Periyakulam, Theni, Tamil Nadu, to investigate the effect of foliar application of organic inputs on growth and quality of Annual *Moringa* variety PKM 1. The experiment was laid out in Randomized Block Design (RBD) with nine treatments each replicated thrice with 63 plants/treatment. The Annual *Moringa* variety PKM 1 seedlings were transplanted at 1.5 m x 0.5 m spacing in plot size of 3.0 m × 3.0 m and Fortified FYM @ 0.5 kg per pit was applied as basal dose. The experiment plot was conducted in sandy loam soil pH-7.35, EC-0.07 dsm^{-1} and organic carbon-0.84% having available nitrogen-282.24 kg/ha, phosphorous-56 kg/ha and potassium-358 kg/ha. Observations on growth, yield and quality parameters were recorded in all treatments.

Table 1: Details of the Treatment

Treatments	Foliar spray
T_1	Control (No spray)
T_2	Sea Weed Extract (4%)
T_3	Panchagavya (3%)
T_4	*Moringa* Leaf Extract (5%)
T_5	*Moringa* Leaf Extract (10%)
T_6	Sea Weed Extract (4%) + *Moringa* Leaf Extract (5%)
T_7	Sea Weed Extract (4%) + *Moringa* Leaf Extract (10%)
T_8	Panchagavya (3%) + *Moringa* Leaf Extract (5%)
T_9	Panchagavya (3%) + *Moringa* Leaf Extract (10%)

All the organic inputs were applied as foliar spray with first spray on 25 days after transplanting (DAT), second spray on 25 days after first harvest. The first harvest of biomass was done 60 days after transplanting, while the subsequent harvest was done on 45th day after first harvest. Solar dryer was used to dry the harvested leaf biomass.

3. Observations recorded

3.1 Growth and Yield parameters

Observations on various growth parameters *viz*., plant height, stem girth, number of branches per plant, numbers of compound leaves per plant, fresh leaf yield per hectare, dry leaf yield per hectare were recorded at five randomly selected plants for each treatment in each replication and the mean was computed.

3.2 Quality parameters

Observations were recorded on various quality parameters *viz*., chlorophyll, β-carotene, ascorbic acid and moisture content at five randomly selected plants of each treatment in each replication and the mean were computed. In accordance with the instructions provided by Yoshida *et al*., (1971) [38], the chlorophyll content was analysed using the acetone method used on spectrophotometer. The method described by Harris and Ray (1935) [15] was used to estimate the ascorbic acid content. According to Jensen (1978) [17], the acetone method was used to determine the β-carotene content of fresh leaf samples. The moisture content was calculated and expressed as percentage of the fresh sample weight (AOAC, 1975) [1]. The data were analysed statistically, with average values calculated as per Panse and Sukhatme, (1985) [25].

4. Results and Discussion

The foliar application of organic inputs *viz*., Sea Weed Extract (SWE), Panchagavya, *Moringa* Leaf Extract (MLE) showed significant effect on growth, yield and quality parameters of Annual *Moringa* variety PKM 1.

4.1 Growth parameters

Effect of foliar application of organic inputs includes improving Annual *Moringa* var. PKM 1 growth parameters *viz*., plant height, stem girth, number of branches per plant, number of compound leaves per plant (Table 2).

4.1.1 Plant height (cm)

The plant height (149.60 cm and 183.00 cm) was recorded significantly higher at T_4: *Moringa* Leaf Extract (5%) in first and second harvest, followed by T_5: *Moringa* Leaf Extract (10%) 141.00 cm in first harvest and 172.20 cm in second harvest. Among all treatments studied, minimum plant height was observed in T_1: Control (No spray) with 123.33 cm in first harvest and 133.60 cm in second harvest (Fig. 1). This indicates that, MLE promoted cell division and lead to greater growth because of high zeatin levels. As the most prevalent cytokinin in the extract, zeatin may be due to responsible for the increased plant height. These Similar findings were reported in lettuce, beans and tomatoes by El-saady and Omar (2017) [9], Rady and Mohamed (2015) [29] and Culver *et al.* (2012) [24].

4.1.2 Stem girth (cm)

The stem girth recorded was significantly higher (6.72cm and 10.50 cm) in the treatment T_4: *Moringa* Leaf Extract (5%) on first and second harvest, followed by T_5: *Moringa* Leaf Extract (10%) on first and second harvest (6.72 and 10.40 cm). The minimum (6.23 cm and 6.88 cm) was observed in

T_1: Control (No spray) on first and second harvest (Fig. 1). The MLE as plant growth hormones are substances that have an impact on flowering, ageing, root development, distorting and death of leaves, stems and other parts, as well as many other situations (Taiz *et al*., 2015) [34]. The results supports the findings in Cowpea (*Vigna anguiculata*) reported by Maishanu *et al*. (2017) [21].

4.1.3 Number of branches per plant

The number of branches per plant was significantly influenced by the treatments and it was observed that T_4: *Moringa* Leaf Extract (5%) when sprayed resulted in 3.15 and 8.40 respectively on first and second harvest, followed by T_5: *Moringa* Leaf Extract (10%) (3.13 and 8.00 respectively) on first and second harvest and the lowest number of branches per plant was observed in T_1: Control (No spray) (2.40 and 3.00) on first and second harvest (Fig. 2). The MLE at a 5% promotes the number of branches which may be due to the supply of macro and micronutrients and growth hormones. These findings are in accordance with Fuglie (2000) [13], who suggested that foliar application of MLE includes a sufficient amount of stimulating components that promote the rate of cell division and cell enlargement. The MLE contains the growth hormone zeatin, which encourages the development of lateral buds, which in turn increases the number of branches. These results support similar finding confirmation in okra where foliar application of MLE enhanced the number of branches when sprayed with extract after grinding 100 g of *Moringa* leaves in 8.0 litres of water (Anyaegbu, 2015) [41], in cowpea with 1:30 dilution (Maishanu *et al*., 2017) [21] and in tomato with 100 percent (Bashir *et al*., 2014) [5].

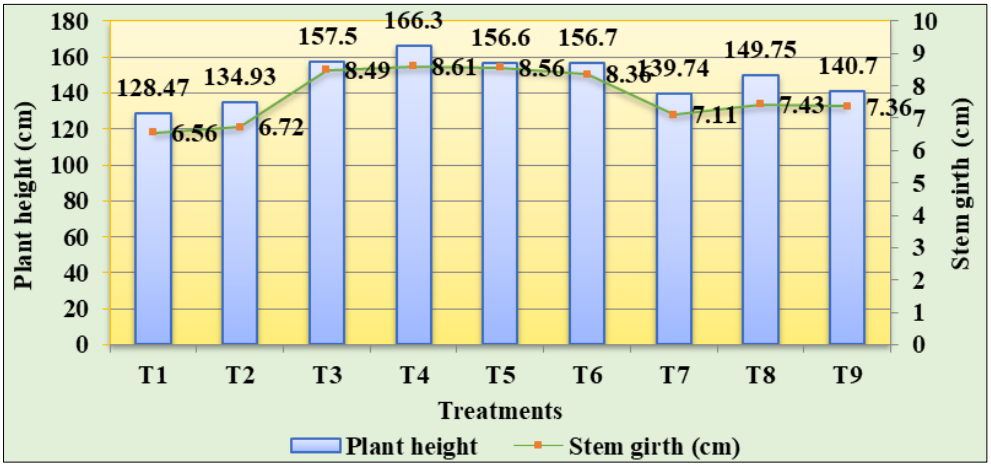

Fig 1: Effect of organic inputs on Plant height (cm) and Stem girth (cm) of Annual *Moringa* var. PKM 1

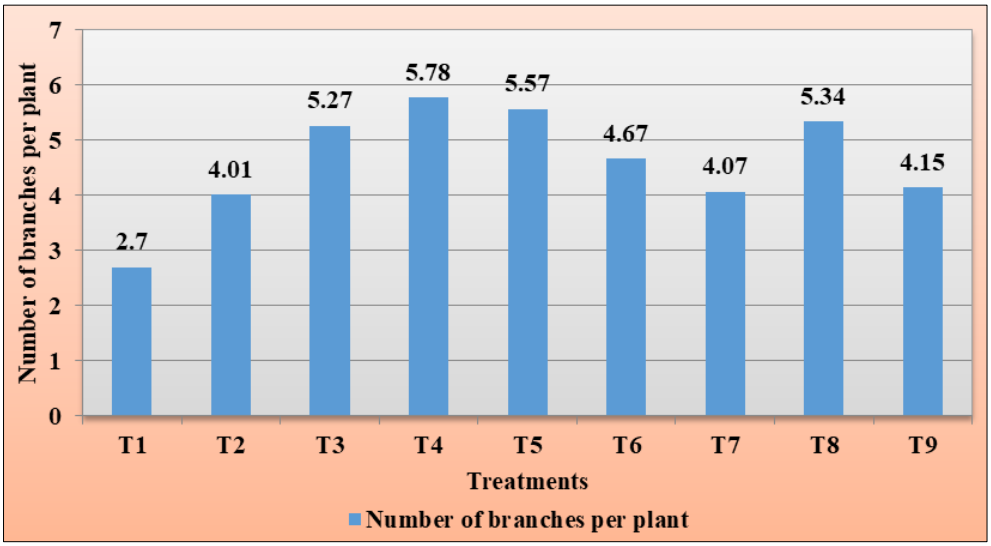

Fig 2: Effect of organic inputs on Number of branches per plant of Annual *Moringa* var. PKM 1

4.1.4 Number of compound leaves per plant

The number of compound leaves per plant was significantly higher in T_5: *Moringa* Leaf Extract (10%) with 30.80 and 68.20 respectively on first and second harvest, followed by T_4: *Moringa* Leaf Extract (5%) with 27.82 and 67.20 respectively. The minimum number of compound leaves per plant was observed in T_1: Control (No spray) (23.50 and 38.80 respectively) on first and second harvest (Fig. 3). This may be due to the MLE treatment on the leaves, which promoted growth through the liberal incorporation of nutrients, amino acids and growth hormones. According to Iqbal (2014) [23], MLE regulates plant growth throughout the vegetative phase and cytokinins play a part in promoting cell division and a larger number of leaves. Emongor (2015) [10], on the other hand, found that, growing MLE at concentrations of 11, 20, 33, and 50 percent increased the number of snap bean leaves.

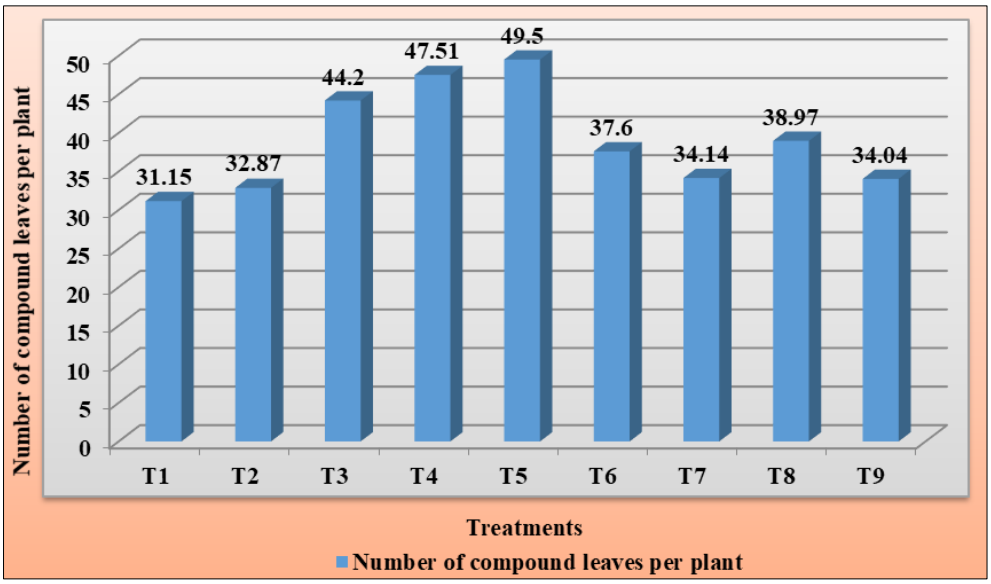

Fig 3: Effect of organic inputs on Number of compound leaves per plant of Annual *Moringa* var. PKM 1

Table 2: Effect of organic inputs on growth parameters of Annual *Moringa* var. PKM 1

Treatments	Plant height (cm)			Stem girth (cm)			Number of branches per plant			Number of compound leaves per plant		
	I Harvest	II Harvest	Mean	I Harvest	II Harvest	Mean	I Harvest	II Harvest	Mean	I Harvest	II Harvest	Mean
T_1	123.33	133.60	128.47	6.23	6.88	6.56	2.40	3.00	2.70	23.50	38.80	31.15
T_2	131.26	138.60	134.93	6.29	7.14	6.72	2.62	5.40	4.01	25.13	40.60	32.87
T_3	139.20	175.80	157.50	6.64	10.34	8.49	2.73	7.80	5.27	26.40	62.00	44.20
T_4	149.60	183.00	166.30	6.72	10.50	8.61	3.15	8.40	5.78	27.82	67.20	47.51
T_5	141.00	172.20	156.60	6.72	10.40	8.56	3.13	8.00	5.57	30.80	68.20	49.50
T_6	140.00	173.40	156.70	6.62	10.10	8.36	2.73	6.60	4.67	26.80	48.40	37.60
T_7	130.27	149.20	139.74	6.32	7.90	7.11	2.73	5.40	4.07	25.27	43.00	34.14
T_8	139.50	160.00	149.75	6.58	8.28	7.43	2.67	8.00	5.34	26.33	51.60	38.97
T_9	135.40	146.00	140.70	6.46	8.26	7.36	2.50	5.80	4.15	26.67	41.40	34.04
SE (d)	7.48	3.39	2.90	0.35	0.19	0.15	0.30	0.15	0.09	1.27	0.85	1.01
CD (0.05)	15.87	7.20	6.16	0.73	0.40	0.33	0.65	0.31	0.19	2.69	1.79	2.14

4.2 Yield parameters

Effect of foliar application of organic inputs in improving Annual *Moringa* variety PKM 1, showed significant difference in yield parameters *viz*., fresh leaf yield per hectare and dry leaf yield per hectare (Table 3).

4.2.1 Fresh leaf yield per hectare (tons/hectare)

The maximum fresh leaf yield per hectare recorded was significantly higher (4.15 tons/ha and 4.18 tons/ha respectively) in T_5: *Moringa* Leaf Extract (10%) on first and second harvest, followed by T_4: *Moringa* Leaf Extract (5%) on first and second harvest (3.43 tons/ha and 3.46 tons/ha respectively). The minimum yield was observed in T_1: Control (No spray) (1.24 tons/ha and 1.40 tons/ha respectively) on first and second harvest. This may be due to the micronutrient zeatin, which may lead to higher leaf area, higher biological yield and more vigorous vegetative growth. These results are consistent with those of Phiri and Mbewe (2010) [26] and Qayyum *et al.* (2007) [28], which reported in increased yield and harvest index of several oil seed and other cereal crops with exogenous administration of phytohormones, particularly zeatin.

4.2.2 Dry leaf yield per hectare (tons/hectare)

The highest dry leaf yield per hectare was significantly influenced in T_5: *Moringa* Leaf Extract (10%) (0.90 tons/ha and 1.12 tons/ha respectively) on first and second harvest, followed by T_4: *Moringa* Leaf Extract (5%) (0.76 tons/ha and 0.82 tons/ha respectively) on first and second harvest whereas the lowest (0.43 tons/ha and 0.46 tons/ha respectively) on first and second harvest was observed in T_1: Control (No spray). This can be described due to the impact of the zinc and gibberellin found in MLE, which are essential in the biomass production. As a result, zinc enhanced the plants produced more biomass (Cakmak, 2008) [6]. The gibberellin that is abundant in MLE also caused the plant's overall dry matter to improve. This results showed similar findings according to Zaki and Rady (2015) [40], where the application of MLE at 1:30 ratio improved the total plant dry weight of bean and in rocket plant with 2 percent MLE (Abdalla, 2014) [2], while Tuna *et al.* (2008) [36] showed a similar outcome in maize plants. The yield parameters *viz*., fresh leaf yield and dry leaf yield per hectare of annual *Moringa* are detailed in Fig. 4.

Table 3: Effect of organic inputs on yield parameters of Annual *Moringa* var. PKM 1

Treatments	Fresh Leaf yield (tonnes/hectare)			Dry Leaf Yield (tonnes/hectare)		
	I Harvest	II Harvest	Mean	I Harvest	II Harvest	Mean
T_1	1.24	1.40	1.32	0.43	0.46	0.45
T_2	1.69	1.70	1.64	0.50	0.51	0.51
T_3	1.70	3.04	2.37	0.56	0.57	0.57
T_4	3.43	3.46	3.30	0.76	0.82	0.79
T_5	4.15	4.18	4.12	0.90	1.12	1.01
T_6	1.96	2.10	2.18	0.50	0.67	0.59
T_7	1.32	1.40	1.36	0.42	0.45	0.44
T_8	1.70	1.77	1.79	0.56	0.58	0.57
T_9	1.58	1.67	1.78	0.53	0.60	0.57
SE (d)	0.35	0.05	0.04	0.01	0.01	0.02
CD (0.05)	0.74	0.11	0.08	0.03	0.03	0.03

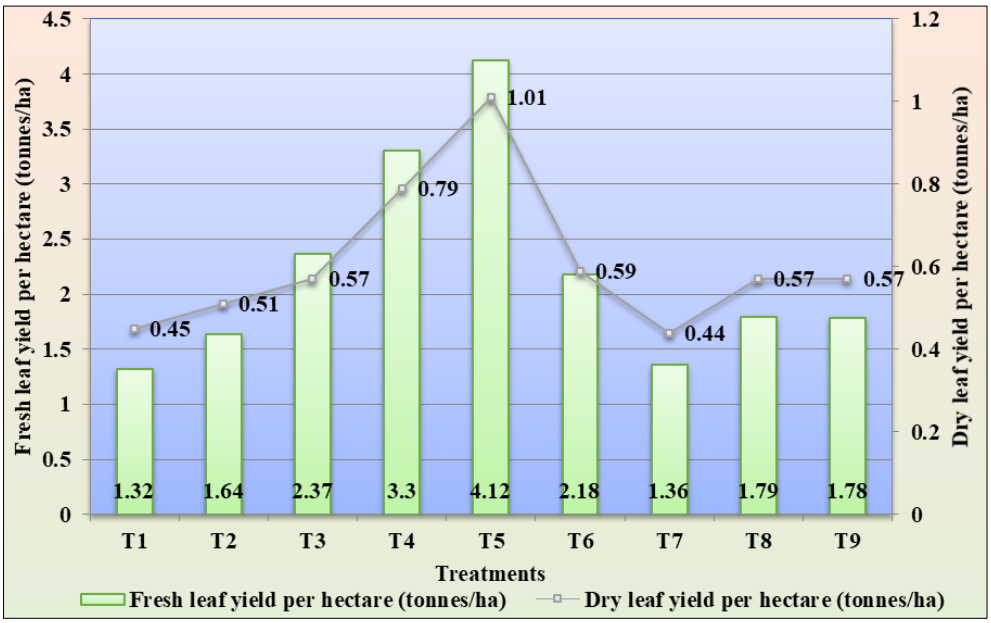

Fig 4: Effect of organic inputs on Fresh leaf yield per hectare (tonnes/ha) and Dry leaf yield per hectare (tonnes/ha) of Annual *Moringa* var. PKM 1

4.3 Quality parameters

The effect of foliar application of organic inputs includes enhancing quality parameters *viz.*, Chlorophyll content, β-carotene content, ascorbic acid and moisture content of Annual *Moringa* var. PKM 1 (Table 4).

4.3.1 Chlorophyll content (mg/g)

The chlorophyll content (Fig. 5) was significantly influenced by all the treatments with the maximum in T_5: *Moringa* Leaf Extract (10%) (6.58 mg/g and 6.66 mg/g respectively) on first and second harvest, followed by T_4: *Moringa* Leaf Extract (5%) (5.58 mg/g and 5.61 mg/g respectively) on first and second harvest and the lowest was observed in T_1: Control (No spray) (3.44 mg/g and 3.47 mg/g respectively) on first and second harvest. These investigations concluded that the mineral nutrients, phytohormones and antioxidants components present in MLE are responsible for delaying of leaf senescence, which is related to the enhanced chlorophyll contents according to MLE application. This result showed similar findings by Shahzad *et al.* (2016) [31] in cherry tomato.

4.3.2 Ascorbic acid content (mg/100 g)

The ascorbic acid content (Fig. 5) observed was significantly higher was observed in (197.70 mg/100 g and 207.62 mg/100 g respectively) on first and second harvest in the treatment T_5: *Moringa* Leaf Extract (10%), followed by T_4: *Moringa* Leaf Extract (5%) 183.90 mg/100 g and 197.80 mg/100 g respectively on first and second harvest and the lowest was observed in T_1: Control (No spray) (131.04 mg/100 g and 142.83 mg/100 g respectively) on first and second harvest. These results are in confirmation with similar work of Yasmeen *et al.* (2013a) [37], where wheat when sprayed with 30 times diluted *Moringa* leaf extract under moderately saline conditions ($8dSm^{-1}$) could reduce the accumulation of Na^+ and Cl^- into shoots, resulting in a yield improvement of 18.5 percent and an increase in total soluble protein, ascorbate content and total soluble phenols.

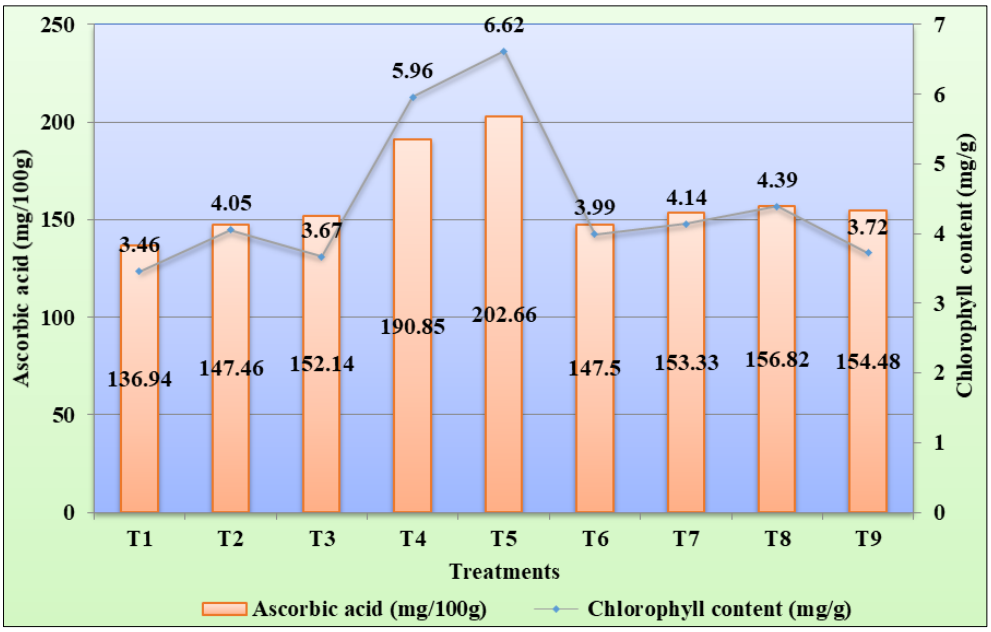

Fig 5: Effect of organic inputs on Ascorbic acid content (mg/100 g) and Chlorophyll content (mg/g) of Annual *Moringa* var. PKM 1

4.3.3 β-carotene content (mg/100 g)

The β-carotene content (Fig. 6) was recorded significantly higher in T_5: *Moringa* Leaf Extract (10%) 10.88 mg/100 g and 12.85 mg/100 g respectively on first and second harvest, followed by T_4: *Moringa* Leaf Extract (5%) 10.82 mg/100 g and 12.80 mg/100 g respectively on first and second harvest and the lowest was observed in T_1: Control (No spray) 6.82 mg/100 g and 7.43 mg/100 g respectively on first and second harvest. *Moringa* leaves can be utilised to boost plant metabolism and help plants to recover from environmental stress, since it contain antioxidants such zeatin, ascorbic acid, phenolic, flavonoids, vitamin E and minerals (Isman, 1997; Latif and Mohamed, 2016) [16, 18].

4.3.4 Moisture content (%)

The moisture content (Fig. 6) recorded was highly significant in overall treatments. The treatment T_5: *Moringa* Leaf Extract (10%) when sprayed resulted in biomass with the maximum moisture content on first and second harvest (7.72 and 7.80% respectively), followed by the T_4: *Moringa* Leaf Extract (5%), the moisture content on first and second harvest was (7.68 and 7.75% respectively) and the minimum (6.50 and 6.75% respectively) was observed in T_1: Control (No spray) on first and second harvest. In order to improve seed germination, yield and plant growth, *Moringa* leaf extract was used as an efficient plant growth hormone (Phiri, 2010) [26].

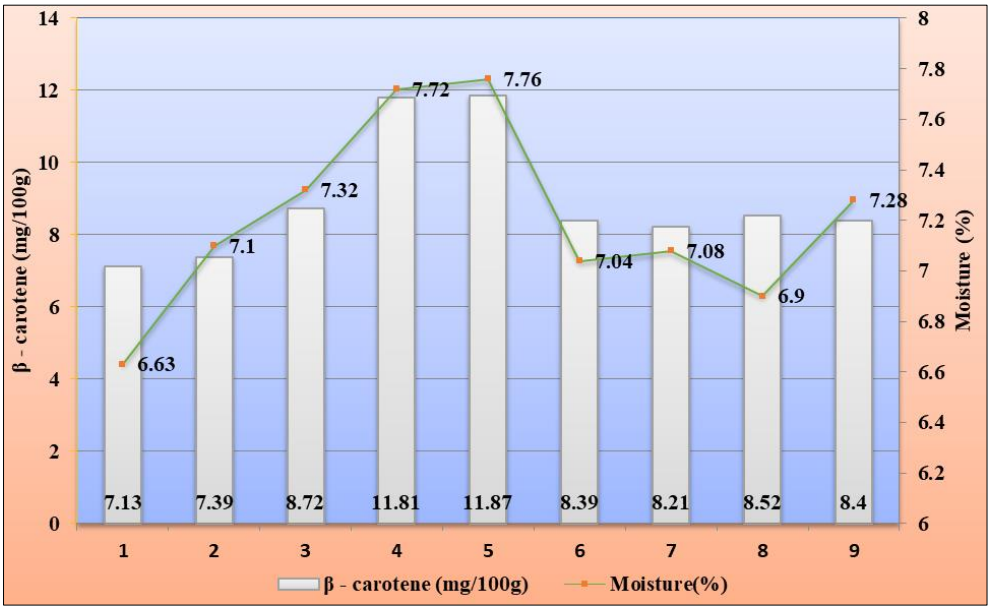

Fig 6: Effect of organic inputs on β-carotene (mg/100 g) and Moisture (%) of Annual *Moringa* var. PKM 1

Table 4: Effect of organic inputs on quality parameters of Annual *Moringa* var. PKM 1

Treatments	Chlorophyll (mg/g)			Ascorbic acid (mg/100 g)			β - carotene (mg/100 g)			Moisture (%)		
	I Harvest	II Harvest	Mean	I Harvest	II Harvest	Mean	I Harvest	II Harvest	Mean	I Harvest	II Harvest	Mean
T_1	3.44	3.47	3.46	131.04	142.83	136.94	6.82	7.43	7.13	6.50	6.75	6.63
T_2	4.06	4.04	4.05	142.53	152.38	147.46	7.24	7.54	7.39	7.00	7.20	7.10
T_3	3.56	3.75	3.67	147.13	157.14	152.14	8.51	8.92	8.72	7.13	7.50	7.32
T_4	5.58	5.61	5.96	183.90	197.80	190.85	10.82	12.80	11.81	7.68	7.75	7.72
T_5	6.58	6.66	6.62	197.70	207.62	202.66	10.88	12.85	11.87	7.72	7.80	7.76
T_6	3.95	4.02	3.99	140.23	154.76	147.50	7.88	8.90	8.39	7.02	7.05	7.04
T_7	4.07	4.20	4.14	147.13	159.52	153.33	7.56	8.86	8.21	7.06	7.10	7.08
T_8	4.34	4.43	4.39	151.73	161.90	156.82	8.22	8.82	8.52	6.80	7.00	6.90
T_9	3.63	3.80	3.72	149.43	159.52	154.48	8.00	8.80	8.40	7.20	7.35	7.28
SE (d)	0.09	0.08	0.08	3.55	3.31	3.57	0.16	0.22	0.20	0.14	0.14	0.13
CD (0.05)	0.19	0.18	0.17	7.53	7.02	7.57	0.35	0.46	0.41	0.29	0.29	0.28

5. Conclusion

In the present study, it is concluded that organic inputs as foliar spray has proved potential in enhancing plant height, stem girth, number of branches per plant, number of compound leaves per plant, fresh leaf yield per hectare, dry leaf yield per hectare, chlorophyll, β-carotene, ascorbic acid and moisture content of Annual *Moringa* var. PKM 1. The highest values amongst the treatments of various combination of organic inputs *viz*., Sea Weed Extract, Panchagavya, *Moringa* Leaf Extract, the treatment T_4: *Moringa* Leaf Extract (5%) came out to be the best for increasing plant height, stem girth, number of branches per plant, whereas T_5: *Moringa* Leaf Extract (10%) resulted best in increasing the number of compound leaves per plant, fresh leaf yield per hectare, dry leaf yield per hectare, chlorophyll content, β-carotene, ascorbic acid, moisture content and yield parameters. Nowadays quality is emphasized over quantity, so the use of organic inputs improves the quality as well as quantity on crop production, with the focus on soil health, environmental health and human health.

6. References

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