Short communication

A miracle multipurpose tree (Moringa oleifera) to recent applications in the agricultural- A review

ABSTRACT

Several research efforts in improving yield have been limited to areas of nursery raising, transplanting time, plant population, provision of good quality seeds and seedlings, weeding, irrigation, fertilizer application and prevalence of pests and diseases. MLE (3.3%) used as seed osmopriming (SP) and/or foliar spray (F), and water as hydropriming (HP). Moringa extract play as a plant hormone which enhances seed germination, growth and yield of crops. MLE foliar spray improved crop performance, resulting from its role on vigorous plant growth, maintained optimum tissue water status, improved membranes stability, enhanced antioxidant content. MLE at concentration of 1:30, found the most effective concentration for causing higher emergence rate and better early seedling growth of spring maize. Tomato plant height, plant dry weight and fruit yield were significantly affected with aqueous Moringa extract and significantly increased the average plant height, average fruit weight, leaves number, number of branches and plant height as well as yield and its components and yield of tomato plant. Sweet bell pepper plants height; number of leaves, fruit weight and yield were also influenced by the application of MLE.

HIGHLIGHTS

Moringa extract has role in agriculture, as animal feed, forage crop, natural plant growth enhancer and bio-pesticide has also been established along with high nutrient content, nutraceutical nature.

Keywords: - MLE, nursery raising, Agronomic traits and osmopriming.

INTRODUCTION

Moringa oleifera Lam. a multipurpose tree with its origin from the sub-Hamaylian tract of India and Pakistan belongs to family Moringaceae (Verdcourt, 1985; Olson and Carlquist, 2001). With fast growing perennial habit, Moringa produces a plenty of biomass and its leaves extracts are being used as plant growth stimulant to improve crop productivity. Moringa leaf extract (MLE) when obtained from fresh leaves are rich in antioxidants, some plant secondary metabolites and osmoprotectants making it natural stimulant for growth. These leaf extracts are also source of many plant growth regulators including zeatin, a cytokinin, vitamins and several mineral elements (Yasmeen *et al*., 2014; Rady and Mohamed, 2015; Rady *et al*., 2015).

MLE can be applied as seed priming or foliar spray and to root zone. Several studies have shown MLE potential in improving crop resistance to drought (Yasmeen *et al*., 2013a), salinity

(Yasmeen *et al*., 2013b; Rady and Mohamed, 2015; Rady *et al*., 2015), heavy metal stress metal and/or salinity tolerance (Howladar, 2014) including crop productivity (Yasmeen *et al*., 2012, Rehman *et al*., 2014; 2015a, b). For instance, Yasmeen *et al*. (2013a) reported improved 100 grain weight and yield with foliar applied MLE under moderate salinity but did not observe the basis of such improvement except for antioxidants and leaf ionic ratio important under salinity. In another field study, Yasmeen *et al*. (2012) found an increase in wheat yield with foliar applied MLE at tillering, booting, jointing and heading stages respectively and reported extended leaf area duration as possible reason for improved yield under late sown conditions.

Rather than Moringa leaves are potential source of vitamin A and C, iron, calcium, riboflavin, b-carotene, phenolics (Nambiar *et al*., 2005) and powerful natural antioxidants (Njoku and Adikwu, 1997). Now-a-days, Moringa plant has attained enormous attention because of having cytokinin, antioxidants, macro and micro nutrients in its leaves (Abdalla and El-Khoshiban, 2012; Abdalla, 2013). Moringa is also considered as "Miracle tree". Today farmers are well aware about application of organic fertilizer to improve their crop production as well as farming land. Applying MLE is a cheap and environment friendly organic technology which increases growth of most vegetable crops like rape, cabbage and tomato, and field crops including maize and common beans. Hence, Moringa leaf extract can be used as an organic fertilizer for the farmers. The effect of Moringa leaf extract is analogous to synthetic hormonal effect because the extract contains zeatin, a purine adenine derivative of plant hormone group cytokinin (Makkar *et al*., 2007) and this zeatin enhances the antioxidant properties of many enzymes and protects the cells from aging effects of reactive oxygen species (Zhang and Ervin, 2004).

Too much work has been done on the use of plant growth hormone Mishra (2008), investigated plant growth regulators enhance growth and yield of Chili pepper by 40%. Martin (2000) and Fuglie (2008) reported increase in plant yield by 25-30% with Moringa oleifera extract used as a plant growth hormone. One of the active substances in Moringa fresh leaf juice is natural zeatin, a plant hormone from the cytokinis group, in a “bio-dynamic: native” state, working in conjunction with the incredibly powerful cocktail of enzymes, vitamins and minerals contained in Moringa juice.

Pepper (*Capsicum annuum* L.) is considering an important fruit vegetable crop belong to family Solanaceae which is the second most important vegetable in the world after tomato for internal consumption and export purpose. It is rich in vitamins A and C and contains appreciable quantities of proteins and minerals Temu and Temu (2005) and Olaniyi and Ojetayo (2010). Pepper seed germination is considered a critical step in the development cycle of the plant, germination rate and seedling growth in pepper plants are very low comparing with the other vegetable seedlings, (Korkmaz and Korkmaz, 2009). Other reports have been showed that Moringa extract play as a plant hormone which enhances seed germination, growth and yield of crops. MLE foliar spray improved crop performance, resulting from its role on vigorous plant growth, maintained optimum tissue water status, improved membranes stability, enhanced antioxidant content, as mentioned by Anwar and Bhanger (2003). Many investigators reported that the effective

concentrations of MLE were differing according to plants type. However, Phiri and Mbewe (2010) revealed that MLE at concentration of (1:10) was forced beans to germinate early and increased duration to first germination by 100%, also increased germination percentage of cowpea while the same concentration lead to reduction in groundnut germination seed. They added also that, this reduction may be attributed to that MLE contain an inhibitory substance for groundnut seed germination.

Table 1. Effect of *Moringa oleifera* Leaf Extract (MLE) in Agriculture

Crops	Treatment/mode of application	Outcome	Reference
Wheat	Foliar Application /blended Moringa leaf extract	Priming and foliar application of leaf extract of Faisalabad origin Moringa performed better regarding wheat seedling emergence and vigor as compared to leaf extracts of Multan origin Moringa and PKM1. Leaf extract of MFSD showed higher biostimulant potential that might be due to presence of higher concentration of biostimulant elements, plant growth promoting substances, mineral nutrients and antioxidants.	Khan S *et al.* 2017
Wheat	Seed osmopriming /foliar spray	MLE (3.3%) was used as seed osmopriming (SP) and/or foliar spray (F), and water as hydropriming (HP). It improved shoot and root lengths, leaf and root scores were found for SP and/or F treatments. Increase or decrease in stem dry weight simultaneously with grain dry weight might contribute for soluble stem reserves towards grain weight as showed by delayed leaf senescence in SP or combined SP+F treatment. The SP and F treatments had also earlier spike emergence and anthesis stage. Plant height, tillers number, biological and grain yields per plant recorded highest for SP+F treatment followed by SP. Thus, MLE being rich in zeatin, a cytokinin maintained the green photosynthetic area and enhanced grain filling that might contributed towards improved grain yield when applied as SP or in combination with foliar.	Rehman U *et al.*, 2017
Tomato	Sprayed at the stem base of the plant	100 ml of distilled water was sprayed at the stem base of the plant labeled F which served as control. Four parameters were determined at each week of the experiment i.e. plant height (PH), number of leaves (NL), number of branches (NB) and number of flowers (NF) at five (5) different times. A corresponding increase appeared in the study area. Treatments D (80g/20ml), C (60g/40m1) B (40g/60ml) and an average plant height, A (20g/80ml). Control was found to have the least of all the growth parameters with an average plant height, leaves number, number of branches and number of flowers of 18.8, 51.0, 9.1 and 1.6. This indicates that, the Moringa leaf extract used significantly increased the growth and yield of tomato plants in all the trials with erect stemming, fresh leaves, regular branching and healthy fruits and regular flowering.	Bashir, K A *et al.*, 2014
Tomato	Spray (applied at 2 and 4 weeks)	Second control where ethanol 80 % was added (ME), Moringa extract applied once at 2 weeks from emergence (M1), Moringa extract applied at 2 and 4 weeks from emergence (M2), and Moringa extract applied every 2 weeks to maturity, starting from two weeks from germination (M3). Moringa extract increased growth and yield of tomato in both greenhouse and field. Moringa extract significantly increased above ground dry matter yield (DM), root dry matter weight and plant height for the crop. Yields obtained at MI, M2 and M3 were increasing in ascending order from M1. The study recommends the application of extract at M3.	Culver M *et al.* 2012
Onion	Foliar	Two and three foliar sprays of 2% brassica, Moringa and brassica + Moringa at 15, 30 and 45 DAS	Mohammed

	application of concentration 2%, 4%, 3.2%, 3.7%.	respectively. The maximum seed yield (2942 kg ha^{-1}), biological yield (13721 kg ha^{-1}) and harvest index (21.44%) were given by T (Three sprays of 2% brassica + 7 2% Moringa at 15, 30 and 45 DAS). The maximum number of siliques $plant^{-1}$ (394.18), number of seeds $silique^{-1}$ (28.93) and 1000-seed weight (4.63 g), were given by T7 (Three sprays of 2% brassica + 2% Moringa at 15, 30 and 45 DAS). Similarly significantly higher leaf area indices, crop growth rates and net assimilation rate were also recorded by T7 (Three sprays of 2% brassica + 2% Moringa at 15, 30 and 45 DAS).	R, *et al.* 2013
Sunflower	Foliar sprays.	Different concentrations of 5%, 10%, 15% and 20% of Moringa leaf extract were applied as treatments that were applied as foliar sprays at different time. The result showed that all concentration of Moringa suppressed the sunflower germination; however Moringa leaf extract in 5% concentration was effective in increasing the seedling growth and development. Experiments showed that Moringa leaf extract sprays in all concentrations at 45 and 60 DAS increased the sunflower seed yield. Thus foliar application of Moringa leaf extract has the potential to increase the seed yield of sunflower and that too in an economic way.	Maqsood Q, *et al*., 2015.
Maize	Leaf extract spray	Application of Moringa leaf extract at 2 weeks after emergence and at every 2 weeks thereafter (T5) significantly increased growth parameters like plant height, shoot length, fresh weight and dry weight of shoot, and yield components like number of grains cob-1, 100-grain weight, and grain weight plant-1. The highest grain yield (9.2 t ha-1), stover yield (10.1 t ha-1) and harvest index (48%) were obtained from T5 while the lowest grain yield (6.3 t ha-1), stover yield (8.6 t ha-1) and harvest index (42%) were found in the treatments where no Moringa leaf extract was used (T1 or T2). Hence Moringa leaf extract should be applied for better growth and yield performance of maize.	Biswas, A K, et al, 2016.
Cotton	Foliar Application	Results illustrated that all the treatments were effective in enhancing growth, number of bolls per plant and boll weight, which ultimately enhanced the seed cotton yield of Bt cotton cultivar CIM 598 yield and fiber quality of both cotton cultivars over the control. The economic analysis revealed that combined foliar application of MLE and potassium nitrate was cost effective for maximizing seed cotton yield and income.	Yasmeen *A et al.*, 2013.
Pepper	Foliar application of MLE	The two concentrations of MLE, 1:10 and 1:20, applied at one and two week's interval. Data were collected on stem girth, plant height, number of leaves and fruit yield. The results indicated existence of significant (P=0.05) differences between the two MLE concentrations with respect to their effects on the growth and yield of pepper. Foliar application of MLE at 1:20 concentration, two weeks interval, gave the highest values of growth and yield parameters of pepper, and hence, it is recommended for pepper producers.	Matthew A.2016
Pepper	Effect of (MLE) on Pepper Seed Germination.	The results indicated that Moringa leaf extract at 4% concentration as seed soaking for 6 hours stimulated germination percentage, rate, index as well as coefficient of germination velocity. Moreover, the same concentration (4%) as a foliar spray on pepper seedlings in the nursery was sufficient to support all seedlings parameters expressed as height, fresh and dray weight, number of leaves and leaf area. The maximum plant growth parameters as well as superior early and total fruit	Hala, H. Abou El-Nour and Nabila, A. Ewais., 2017.

		yield were obtained from the same treatment. Furthermore, MLE at concentration of 4% increased average fruit weight, length and diameter as well as fruit chemical contents such as carbohydrate, ascorbic acid and both of K and Ca elements.	
Fennel	Foliar application of MLE leaf extracts	The individual treatment of aqueous MLE at 5% or BA at 100 ppm gave the best results of the previous mentioned characteristics followed by 5% ethanolic MLE or 50 ppm BA compared to the control and the rest of tested individual ones. The highest values of all studied parameters were obtained by using 5% aqueous or ethanolic MLE combined with 100 ppm BA. The increments were 91.1% and 85.3% in fruit yield/feddan, 52.5% and 46.3% in volatile oil percentage and 192.4% and 172.0% in oil yield/feddan, respectively over the control. The major component of volatile oil was methyl chavicol (estragole) with concentration range from 77.5% to 87.3%. And minor compounds were myrcene and limonene. The best treatment for decreasing the concentration of methyl chavicol (77.5%), which is undesirable component in fennel oil, resulted from the combination of 5% aqueous MLE plus 100 ppm BA. Therefore, it could be recommended that spraying fennel plants with 5% aqueous MLE plus 100 ppm BA for obtaining higher vegetative growth, fruit and oil yield.	S.S.A. Abdel-Rahman *et al.* 2019
Hollywood Plum	Sprayed with (0%, 4%, 5%, 6%)	Trees were sprayed with (0%, 4%, 5%, and 6%) Moringa (Moringa oleifera L.) leaf aqueous extract at full bloom stage+fruit setting stage+two weeks after fruit setting stage. Plums treated with 6% Moringa leaf aqueous extract exhibited significantly higher setting, yield, fruit weight, firmness, color, Soluble Solid Content (SSC), Titrable Acidity (TA) ratio, ascorbic acid, Anthocyanin content, antioxidant activity contents and reducing titrable acidity with reduced fruit drop as compared to all other treatments. It can be concluded that, foliar applications of 6% Moringa leaf aqueous extract can be used effectively to improve fruit set, yield, fruit weight, firmness, color, soluble solids content, vitamin C, Anthocyanin content and antioxidant activity of "Hollywood" plum.	Thanaa ShM 2017
Kinnow	Sprayed with 3% MLE, 0.6% ZnSO4and 0.25% K2SO4.	Combined application of MLE, K and Zn at fruit set stage in both experiments resulted in significantly lower fruit drop and higher fruit set, yield, fruit weight, juice weight, soluble solid contents (SSC), vitamin C, sugars, total antioxidants and total phenolic contents. Activities of SOD and CAT enzymes in fruit juice were significantly increased with 3%MLE application in both experiments. Conclusively, combined foliar application of 3% MLE, 0.6% ZnSO4and 0.25% K2SO4at fruit set stage can be used effectively to improve leaf nutrient status, fruit yield and quality of 'Kinnow' mandarin trees.	N Maryam 2016
Brassica	Foliar sprays of 2% brassica, Moringa and brassica + Moringa at 15, 30 and 45.	The leverage of both MSE+LRE in alleviating the doubled stress in plants reflecting better growth and yield is found to be due to the improved antioxidant defense systems; non-enzymatic and enzymatic antioxidants (i.e., free proline, TSS, carotenoids, CAT, POD, SOD, APX, and GR) to decline the ROS damages by the addition of minerals-, osmoprotectants-, phyto hormones-, Se-, and vitamins-containing MSE and LRE applied, especially as integrative additions through drip irrigation and foliar spray, respectively that reported herein as the best integrative treatment. The leverage of both MSE and LRE also is reported in our study as "stay-green effect" due to the MSE+LRE active components (i.e., mineral nutrients, phyto hormones, soluble sugars, and amino acids), supporting the antioxidative	Muhammad Aamir Iqbal 2014

		defense systems in plants under severe stress.	
Mungbean	There were six treatments having different concentrations of extracts (2.5, 5.0, 7.5, 10.0, 12.5 and 15.0%).	The experimental treatments were comprised of two and three foliar sprays of 2% brassica, Moringa and brassica + Moringa at 15, 30 and 45 DAS respectively. The maximum seed yield (2942 kg ha^{-1}), biological yield (13721 kg ha^{-1}) and harvest index (21.44%) were given by T (Three sprays of 2% brassica + 7 2% Moringa at 15, 30 and 45 DAS). The maximum number of siliques plant 1 (394.18), number of seeds $siliques^{-1}$ (28.93) and 1000-seed weight (4.63 g), were given by T7 (Three sprays of 2% brassica + 2% Moringa at 15, 30 and 45 DAS). Similarly significantly higher leaf area indices, crop growth rates and net assimilation rate were also recorded by T7 (Three sprays of 2% brassica + 2% Moringa at 15, 30 and 45 DAS).	Md. Moktar Hossain 2018
Spray on three leguminous and forages crops	Spray four concentrations of Moringa leaf extract (C1, C2, C3 and C4.	Treatments consisted of four concentrations of Moringa leaf extract (C1=1ml of juice+10 ml of distilled water, C2=1ml of juice+20ml of distilled water, C3=1ml of Juice+30 ml of distilled water and C4=1ml of juice+40 ml of distilled water) and only distilled water as control. Results showed that the higher concentration C1 contained the highest concentrations of inorganic elements and growth hormones compared to the other concentrations. Significantly higher growth and forage yields of both alfalfa and clitoria and significantly higher growth and grain yield of mung bean. The highest concentration C1 increased number of pods, pod dry weight, seed dry weight, and shelling out turn of mung bean compared to the control in year 2015 by 85, 60, 47 and 92%, respectively. Corresponding increments in 2016 for the same characters were 40, 47, 27 and 94%, respectively.	R.A. Abohassan and A.O. Abusuwar 2018
Purple nut sedge	MLE was applied into pots with distilled water.	Growth of two maize hybrids P-33H25 and FH-810 evaluated under well watered and water deficit situations as affected by Si application. Silicon was added in soil @ 100 mg/kg. Plants were grown with two levels of soil water content viz. 100 % and 60 % of field capacity. In drought-stressed plants of hybrid P-33 25 and FH-810 silicon application significantly increased plant height (129.04 cm and 120.00 cm), stem diameter (1.23 cm and 1.22 cm), number of leaves (13.26 and 13.20), cob length (13.96 cm and 12.83 cm), number of grains/cob (235.05 and 215.35), 100 grain weight (19.65 g and 18.51 g), grain yield (46.18 g and 39.88 g) and biological yield (115.46 g and 102.34 g) along with improvement in photosynthetic rate and lowered transpiration rate, respectively. In conclusion, silicon application to drought stressed maize plants improved the growth and yield which could be attributed to improved photosynthetic rate and lowered transpiration.	Anser Ali *et al.* 2015
Bean	Sprayed twice with Moringa leaf extract (MLE).	*Phaseolus vulgaris* plants were grown in the presence of NaCl and/or CdCl2 beginning from the second week, sprayed twice with Moringa leaf extract (MLE) at 21and 28 days after sowing (DAS), and were sampled at 35 DAS for growth and chemical analyses and yielded at the end of experiment. Growth traits, level of photosynthetic pigments, green pod yield and pod protein were significantly reduced with exposing the plants to NaCl and/or CdCl2. However, the follow up foliar application with MLE detoxified the stress generated by NaCl and/or CdCl2 and significantly enhanced the fore mentioned parameters. Either individual or combined used stresses increased the electrolyte leakage	Saad M. Howladar 2014

		(EL), lipid peroxidation and plant Cd2þ content, and decreased the membrane stability index (MSI) and relative water content (RWC). However, the foliar application of MLE in the absence of the stress improved the MSI and RWC and minimized plant Cd2þ content but could not affect EL and lipid peroxidation. Proline content and the activity of antioxidant enzymes showed a significant increase in response to MLE as well as to NaCl and/ or CdCl2 stress.	
Potato tubers	Using silicon (Si) and Moringa Seed extract (MSE) for reducing heavy metal contamination.	Various sources of phosphate fertilizers as ordinary super phosphate and rock phosphate were added at rate of 100 kg P ha−1 prior sowing. Silicon was added as potassium silicate (20% SiO2) at rate of 6 L ha^{-1}, and MSE was also added at rate of 150 L ha^{-1} in three equal doses with the 2nd, 4th, and 6th irrigations during the last 10 min of drip irrigation. Results indicated that the addition of phosphate fertilizers increased fresh tuber yield, dry weight yield, NPK uptake, catalase, peroxidase, superoxide dismutase, and glutathione reeducates of potato either alone or combined with silicon and MSE. The accumulation rate of Cu, Cd, and Ni in potato was higher with the single addition of rock phosphate fertilizer compared with single addition of super phosphate fertilizer. The highest reduction ($P < 0.05$) in heavy metal accumulation in potato leaves and tubers as well as soil was found with MSE treatment plus super phosphate fertilizer. It is recommended to add MSE at a rate of 150 L ha−1 along with fertilizing the potato crop with ordinary super phosphate fertilizer.	Elrys, A. S.*et al.* 2019
Brinjal	Application of the Moringa extracts on the soil.	Soil pH was improved from 5.4 to 6.7 with application of Moringa extracts. In both 2012 and 2013, highest fruit yields (9.5 t ha -1 in 2013 and 10.5 t ha -1 in 2013) were obtained from stands of garden egg that received Moringa leaf extract combined with NPK fertilizer applied at the rate of 100 kg ha^{-1} . The yield of the crop was also improved by application of poultry manure though not significantly different from those given the solution obtained by soaking the bark and cut branches of Moringa stands. In all, the poorest results were obtained from the control plots. Having found that Moringa is a good growth enhancer, the study therefore recommends that Moringa which is readily available to be used as a substitute to chemical fertilizers that are usually scarce and costly.	Anyaegbu Polycarp Ozobia 2014
Rocket plants	Foliar spray with the aqueous extracts at rates of 1, 2 and 3%.	Rocket (*Eruca vesicaria subsp. sativa*) plants were foliar sprayed with the aqueous extracts of leaves and twigs of M. oleifera at rates of 1, 2 and 3%. Among these concentrations, fertilization of rocket plants with 2% leaf and 3% twig extracts potentially increased all measured growth criteria (plant height, fresh and dry herb weight), photosynthetic rates, stomatal conductance, the amounts of each of chlorophyll a and b, carotenoids, total sugars, total protein, phenols, ascorbic acid, N, P, K, Ca, Mg, Fe as well as growth promoting hormones (auxin, gibberellins and cytokinins). Besides, bio-organic manuring with both kinds of Moringa extracts at all concentrations applied negatively reduced the levels of each of lipid peroxidation and Abscisic acid as well as the activities of the antioxidant enzymes (catalase, peroxidase and superoxide dismutase). Thus, it is concluded that M. oleifera leaf and twig extracts can be recommended to be used effectively by farmers as a bio-organic fertilizer for various crops due to its high productivity, high nutritive value, and antioxidant effect, and easy preparation, low cost and environmentally friendly nature.	Mona M. Abdalla 2014

Some chemical constituents of MLE Component	Value (mg g−1 DW)
Amino acids	106.20
Proline	21.00
Total soluble sugars	248.70
Ash	102.00
Calcium	28.00
Magnesium	6.70
Potassium	25.10
Phosphorus	8.10
Sodium	0.75
Iron	1.60
Manganese	0.84
Zinc	0.27
Copper	0.14
Soluble phenols	6.20
Total carotenoids	3.10
Total chlorophyll	3.96
Ascorbic acid (mg 100g−1 FW)	242.40
Phytohormones (μg g−1 DW):	
Indole-3-acetic acid	0.83
Gibberellins	0.74
Zeatin	0.96
Abscisic acid	0.29 `
Source: Rehman *et al.*, (2017)	

Table 2. Some chemical constituents of MLE Component and values.

Table 3. Nutrients composition of leaf, seed and root				
S.No.	**Nutrient**	**Leaf**	**Seed**	**Root**
1	Energy values (Kcal/100 g)	426.12	426.12	384.05
2	Crude proteins (%)	27.60	28.02	5.02
3	Crude lipids (%)	20.00	33.78	6.33
4	Carbohydrates (%)	33.93	28.77	76.75
5	Ash (%)	11.60	3.03	4.97
6	Thiamine B_1 (mg/100 g)	18.47	-	-
7	Riboflavin B_2 (mg/100 g)	14.82	-	-
8	Pyridoxine B_6 (mg/100 g)	57.29	-	-
9	Ascorbic acid (mg/100 g)	773.30	94.74	48.13
10	Niacin B_3 (mg/100 g)	50.35	-	-
11	Calcium (mg/100 g)	13.45	2.84	3.99
12	Sodium (mg/100 g)	104.06	129.03	514.80
13	Potassium (mg/100 g)	20.81	-	15.4
Source: (Igwilo *et al*., 2017)				

CONCLUSION

Agronomic traits is refers for controlling yield and most of the yield-related traits. This behavior of crops had similar patterns in their interactions with different foliar applications during the field trials. Application of Moringa extract with different concentration have a good potential for improving growth and yield of crops since Moringa extract has some nutritional potentials and it can also improve the nutrient of onion. Application of extract with 50% concentration and twice application should be adopted of onion tested, since it is easier to get all year round and in large quantities for large hectare of farm land. Moringa, with emerging awareness regarding it's as a potential crop with the 597 multiple uses, as found from various studies in the past years. Besides, its role in agriculture, as animal feed, forage crop, natural plant growth enhancer and bio-pesticide has also been established along with high nutrient content, nutraceutical nature.

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