Impact of Micronutrients and Plant Bioregulators on Yield of Okra and Potato

Pradeep Kumar and V. K. Dhangrah

Research Journal of Agricultural Sciences
An International Journal

P- ISSN: 0976-1675
E- ISSN: 2249-4538

Volume: 12
Issue: 05

Res Jr of Agril Sci (2021) 12: 1485–1488

CARAS

Res. Jr. of Agril. Sci. (Sep-Oct 2021) 12(5): 1485–1488
www.rjas.org

Full Length Research Article

Impact of Micronutrients and Plant Bioregulators on Yield of Okra and Potato

Pradeep Kumar*[1] and V. K. Dhangrah[2]

Received: 07 June 2021 | Revised accepted: 29 Jul 2021 | Published online: 02 Sep 2021

A B S T R A C T

A field experiment was conducted at Research Farm of I.F.T.M University, Lodhipur Rajput, Moradabad (U.P.). India to evaluate the impact of micronutrients and plant bio-regulators on yield of okra and potato crop. The experiment consists of 16 treatment combination with some foliar application micronutrients and plant bio-regulators which were laid out in factorial randomized design with three replications. Maximum fruit yield q/ha of okra was 154.88 and 159.50 was noted with application of M_0 (RDF) which was statistically at par with application of M_1 (Zn-2g/l) and M_3 (Bo-2g/l) during first year however during second year it was at par with M_1 (Zn-2g/l) only. Minimum fruit yield q/ha of okra was 140.88 and 145.20 was noted under treatment M_2 (SI-2ml/l) during first and second year of experimentation respectively. Maximum fruit yield was noted as 154.00 q/ha and 158.68 q/ha under application of P_1 (GA_3 @100 ppm) which was non significantly followed by P_0 (RDF) and P_3 (Humic acid 2ml/l) and significantly followed by P_2 (Na para nitro phenolate 2 ml/l) during both respective years of study. Maximum tuber yield (q/ha) of potato was 329.85 and 339.68 was noted with application of M_0 (RDF) which was statistically on par with application of M_1 (Zn-2g/l) and M_3 (Bo-2g/l) during first year however during second year it was at par with M_1 (Zn-2g/l) only. Maximum tuber yield was noted as 326.70 q/ha and 336.33 q/ha under application of P_1 (GA_3 @100 ppm) which was non significantly followed by P_0 (RDF) and P_3 (Humic acid 2ml/l) and significantly followed by P_2 (Na para nitro phenolate 2 ml/l) during both respective years of study. Minimum tuber yield (q/ha) of was 268.25 and 276.13 was noted under treatment M_2 (SI-2ml/l) during first and second year of experimentation respectively.

***Key words*:** Micronutrients, Potato, Okra, Bioregulators, Yield

Okra (*Abelmoschus esculentus* L.) belongs to the Malvaceae. Okra is a warm-season as well as rainy season of both tropical and subtropical regions of the world. India ranks first in the world with a total area under okra crop is 509.0 thousand hectare which produces 6094.9 thousand MT with average productivity 12 MT ha-1. In Madhya Pradesh okra is grown in 43.76-thousand-hectare area with a production of 638.34 thousand MT and 14.59 MT ha^{-1} productivity. In Tikamgarh district okra is grown in 1.24-thousand-hectare area with a production of 15.44 thousand MT [1].

Okra pod contains many nutritional contents which important for human health. It contains good amount of potassium, calcium, magnesium, phosphorus, vitamin 'A' and 'C'. The edible fruit of okra one hundred gram of fresh pod has around; 1.9 g of protein, 0.2 g fat, 6.4 g carbohydrate, 0.7 g minerals and 1.2 g fiber [2]. Okra (*Abelmoschus esculentus*) and potato (*Solanum tuberosum*) are important vegetable crops. Deficiency of micronutrients is common problem in vegetable crops. Foliar fertilization with multi-nutrients to achieve balanced plant nutrition is considered to play a significant role in modern sustainable vegetable production. A number of studies have highlighted the benefits of foliar fertilization in improving plant growth, crop yield, nutrient uptake and product quality [3-4]. In India, okra is cultivated in an area of 509 thousand ha with the production of 6094.0 million tones and average productivity of 12 Metric tons/hectare in 2017-18 [5]. In India, potato is cultivated in an area of 2141.7 thousand ha with the production of 51310 metric tons and average productivity of 24 Metric Tons/hectare in 2017-18 [5]. It has since spread around the world and become a staple crop in many countries. Raw potato is 79% water, 17% carbohydrates, 2% protein, contains negligible fat. In a 100 grams amount, raw potato provides 322 kilojoules and is a rich source of vitamin B_6 and vitamin C.

* Pradeep Kumar
✉ pradeep.kumar0074@gmail.com

[1] Department of Horticulture (Vegetable Science), IFTM University Lodhipur Rajput, Moradabad - 244 102, Uttar Pradesh, India

[2] IFTM University Lodhipur Rajput, Moradabad - 244 102, Uttar Pradesh, India

MATERIALS AND METHODS

A field experiment was conducted at Agronomy Research farm of I.F.T.M University, Lodhipur Rajput, Moradabad, (U.P.) India to evaluate effect of micronutrients and plant bio-regulators on growth of okra and potato crop. The experiment consists of 16 treatment combination with some foliar application macro and micro nutrients which were laid out in Factorial randomized design with three replications. There are 16 treatments viz. T_1: Control (RDF), T_2: RDF + GA_3, T_3: RDF + Na para nitro phenolate, T_4: RDF + Humic acid, T_5: RDF + Zn, T_6: RDF + SI, T_7: RDF + Bo, T_8: Zn + GA_3, T_9: Zn + Na Para nitro phenolate, T_{10}: Zn + Humic acid, T_{11}: SI + GA_3, T_{12}: SI + Na para nitro phenolate, T_{13}: SI + Humic acid, T_{14}: Bo + GA_3, T_{15}: Bo + Na para nitro phenolate and T_{16}: Bo + Humic acid. (Micronutrients- M_0-RDF, M_1 –Zn, M_2-SI, M_3-Bo) Plant Bio-regulators- P_0-RDF, P_1-GA_3, P_2- Na para nitro phenolate, P_3- Humic acid).

RESULTS AND DISCUSSION

Tuber yield (q/ha)

The data clearly indicates that different micronutrients have their significant influence on tuber yield (q/ha) of potato. Maximum tuber yield of potato was noted as 329.85 q/ha and 339.68 q/ha with application of M_0 (RDF) in 2019-20 and 2020-21 respectively which was statistically on par with application of M_1 (Zn-2g/l) and M_3 (Bo-2g/l) during first year however during second year it was at par with M_1 (Zn-2g/l) only. Minimum tuber yield of potato was noted as 268.25 q/ha and 276.13 q/ha under treatment M_2 (Sl-2ml/l) during first and second year of experimentation respectively. The application of bio-regulators expressed their effect significantly on tuber yield of potato was noted as 326.70 q/ha and 336.33 q/ha under application of P_1 (GA_3 @100 ppm) which was non significantly followed by P_0 (RDF) and P_2 (Na para nitro phenolate 2 ml/l) and significantly followed by P_3 (Humic acid 2 ml/l) during both respective years of study. Minimum tuber yield of potato i.e., 283.20 q/ha and 291.60 q/ha was noted when P_3 (Humic acid) bio-regulator was applied during 2019-20 and 2020-21. Combined effects of micronutrients and bio-regulators were also significant scrutining of data indicates that maximum tuber yield of potato was 371.20 q/ha and 382.00 q/ha was recorded under combination of M_0 (RDF) × P_1 (GA_3 @100 ppm) followed by rest combinations. Minimum tuber yield of potato was noted when M_2 (Sl-2ml/l) was combined with P_3 (Humic acid) the trend of data was similar both the years of study.

Table 1 Effect of micronutrients and plant bioregulators on tuber yield (q/ha) of potato in okra -potato -fallow cropping system (2019-20)

Plant bioregulators	Micronutrients				
	M_0	M_1	M_2	M_3	Mean
P_0	289.40	356.20	283.00	345.70	318.58
P_1	371.20	335.80	273.80	326.00	326.70
P_2	344.40	319.10	263.30	309.70	309.13
P_3	314.40	287.10	252.90	278.40	283.20
	329.85	324.55	268.25	314.95	309.40
		2020-21			
P_0	298.00	366.90	291.00	356.00	327.98
P_1	382.00	345.90	282.00	335.40	336.33
P_2	354.80	328.70	271.20	318.70	318.35
P_3	323.90	295.80	260.30	286.40	291.60
	339.68	334.33	276.13	324.13	318.56
		2019-20		2020-21	
		SE(m)	CD (p=0.05)	SE(m)	CD (p=0.05)
Between levels of micronutrients (M)		4.861	14.040	4.789	13.832
Between levels of bioregulators (P)		6.276	18.126	6.183	17.858
Between interaction of micronutrients (M×P)		10.870	31.395	10.709	30.930

Fruit yield q/ha

The data presented in study clearly indicates that different micronutrients have their significant influence on fruit yield of okra. Maximum fruit yield of okra was noted as 154.88 q/ha and 159.50 q/ha with application of M_0 (RDF) which was statistically on par with application of M_1 (Zn-2g/l) and M_3 (Bo-2g/l) during first year however during second year it was at par with M_1 (Zn-2g/l) only. Minimum fruit yield of okra was noted as 140.00 q/ha and 145.20 q/ha under treatment M_2 (Sl-2ml/l) during first and second year of experimentation respectively.

It is evident that application of bio-regulators expressed their effect significantly on fruit yield of okra. Maximum fruit yield of okra was noted as 154.00 q/ha 158.68 q/ha under application of P_1 (GA_3 @100 ppm) which was non significantly followed by P_0 (RDF) and P_3 (Humic acid 2ml/l) and significantly followed by P_2 (Na para nitro phenolate 2 ml/l) during both respective years of study. Minimum fruit yield of okra i.e., 139.13 q/ha and 143.40 q/ha was noted when P_2 (Na para nitro phenolate 2 ml/l) bio-regulator was applied during 2019-20 and 2020-21 respectively.

Combined effects of micronutrients and bioregulators were also significant scrutining of data indicates that maximum fruit yield of okra was noted as 182.00 q/ha and 187.60 q/ha under combination of M_0 (RDF) × P_1 (GA_3 @ 100 ppm) followed by rest combinations. Minimum fruit yield of okra was noted when M_2 (Sl-2ml/l) was combined with P_2 (Na para nitro phenolate 2 ml/l) the trend of data was similar during both the years of study.

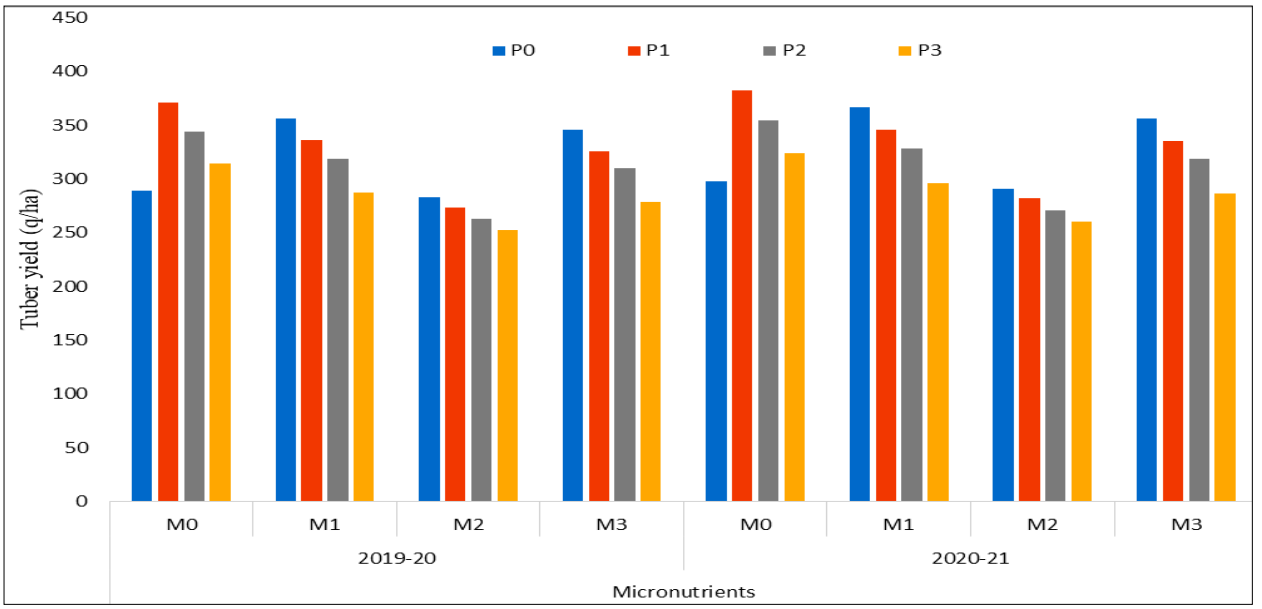

Fig 1 Effect of micronutrients and plant bio-regulators on tuber yield (q/ha) in okra -potato -fallow cropping system

Table 2 Effect of micronutrients and plant bioregulators on fruit yield q/ha of okra in okra -potato -fallow cropping system

Plant bioregulators	Micronutrients				
	M_0	M_1	M_2	M_3	Mean
P_0	133.00	161.00	154.00	161.00	152.25
P_1	182.00	147.00	140.00	147.00	154.00
P_2	147.00	140.00	133.00	136.50	139.13
P_3	157.50	143.50	136.50	143.50	145.25
	154.88	147.88	140.88	147.00	147.66
		2020-21			
P_0	137.00	165.90	158.60	165.90	156.85
P_1	187.60	151.40	144.30	151.40	158.68
P_2	151.40	144.30	137.30	140.60	143.40
P_3	162.00	147.80	140.60	147.90	149.58
	159.50	152.35	145.20	151.45	152.13
		2019-20		2020-21	
		SE(m)	CD (p=0.05)	SE(m)	CD (p=0.05)
Between levels of micronutrients (M)		2.434	7.031	2.209	6.379
Between levels of bioregulators (P)		3.143	9.076	2.851	8.235
Between interaction of micronutrients (M×P)		5.443	15.721	4.939	14.264

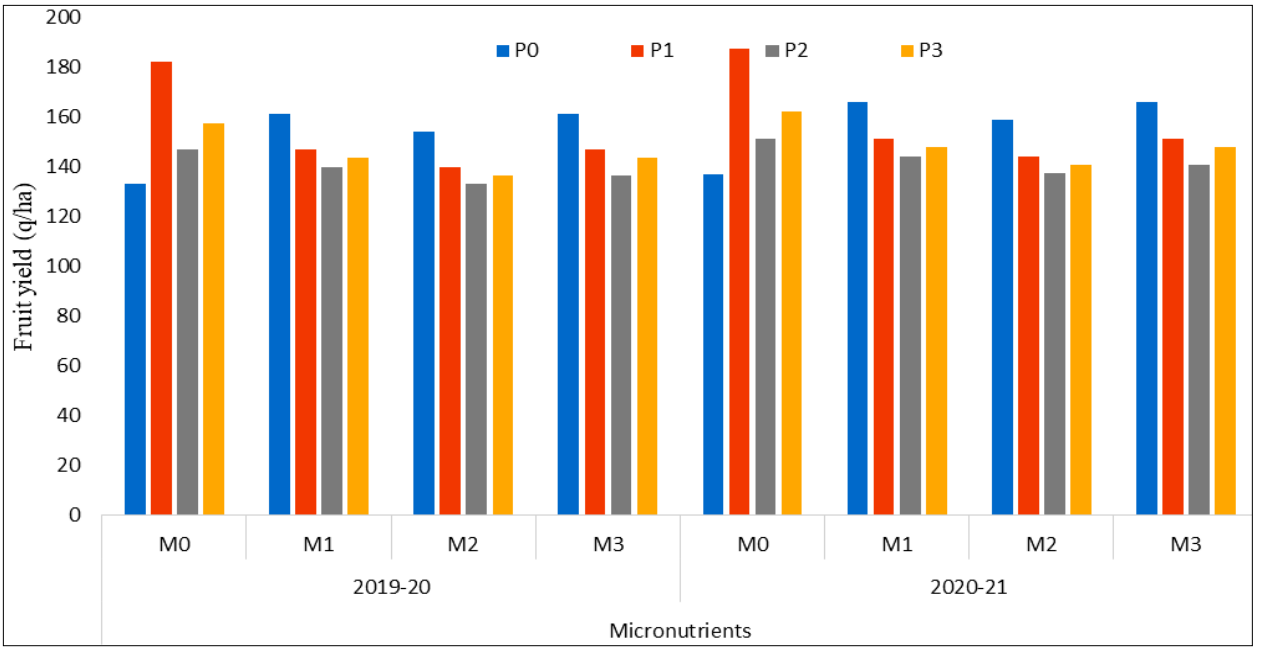

Fig 2 Effect of micronutrients and plant bioregulators on Tuber yield q/ha of Okra in okra -potato -fallow cropping system

However, it may be concluded from the following results that the variety Arka anamika of okra can be used under different programmes as its yield and its contributing characters express in different agro-climatic conditions. Seed production of okra sown on three dates 20th June, 10th and 30th July in three row spacing (30, 45 and 60 cm) and subjected to one to four pickings of green fruits [6]. They found that seed yield, seed weight and weight of dry (mature) pods per plant were adversely affected by late sowing, wider row spacing and a greater number of pickings. However, two picking of green fruits affected the seed yield and contributed towards maximum profit.

Maximum tuber yield of potato was noted as 329.85 q/ha and 339.68 q/ha with application of RDF which was statistically on par with application of M_2 (Zn-2g/l) and M_4 (Bo-2g/l) during first year however during second year it was at par with M_2 (Zn-2g/l) only. Minimum tuber yield (q/ha) of potato was noted when M_3 (Sl-2ml/l) was combined with P_3 (NA para nitro phenolate 2 ml/l) [7-9]. It is evident form the current study of potato cropping system be concluded from the following results that the variety Kufri Chipsona-1 of potato can be used under different programmes as its yield and its contributing characters express in different agro-climatic conditions. Recommended a spacing of 16 to 20 cm with two plants per hill for maximum economic return form summer crop [10]. In another experiment they obtained the maximum fruit yield per plant and per hectare under 60×40 cm and 60×20 cm respectively. Effect of N, P and K at 60, 30 and 30 Kg ha^{-1} respectively in various combination and reported that the two nutrient combinations gave better crop growth and yield [11]. Out of these combinations N, K was found to be the most effective followed by N, P and P, K. The highest yield of Okra was obtained with an application at 96 Kg ha^{-1} each N and P, followed by 48 Kg N and 48 Kg P ha^{-1} [12]. However, the maximum economic return was associated with the application of 48 Kg ha^{-1} each of N and P. The application of potassium had a marked effect on the yield of large medium and small sized tubers, but had no effect on very small sized tubers [13]. The yield was large and medium sized tubers was increased progressively with the increasing levels of potassium. The difference between 50, I. and 150 Kg K2 °/ha in the production of large (More than 75 gm medium and small sized less than 25 gm) tubers befit non-significant. I-E further concluded that the increase yield due to potassium application was mainly the function of the size of % tubers.

CONCLUSION

It can be concluded from the study that maximum yield of potato and okra was achieved using the treatment combinations by the impact of micronutrients and different bio-regulators. Application of RDF and followed by spray of GA_3 @ 100 ppm on okra and potato crop is good management practice for obtaining higher yield along with quality produce. Simultaneous application of micronutrients and plant bio-regulators may have antagonism effect on growth, yield and quality of okra and potato crop. The variety Arka Anamika of okra can be used under different programmes as its yield and its contributing characters express in different agro-climatic conditions.

LITERATURE CITED

1. Anonymous. 2018. *Horticultural Statistics at a Glance*. Horticulture Statistics Division, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India.
2. Vennila C, Jayanthi C. 2008. Response of okra to integrated nutrient management. *Journal of Soil and Crops* 18(1): 36-40.
3. Dev P, Prakash S, Singh M, Kumar V, Bhadana G. 2017. Study on the impact of foliar application of bioregulators and nutrients on the reproductive parameters of Okra (*Abelmoschus esculentus* (L.) Moench) cultivation. *Journal of Pharmacognosy and Phyto Chemistry* SP1: 449-452.
4. Sajid M, Khan MA, Rab A, Shah SNM, Arif M, Jan I, Hussain Z, Mukhtiar M. 2012. Impact of nitrogen and phosphorus on seed yield and yield components of okra cultivars. *The Journal of Animal and Plant Sciences* 22(3): 704-707.
5. Anonymous. 2018. *Agricultural Statistics at a Glance*. Government of India. Ministry of Agriculture and Farmers Welfare Department of Agriculture, Cooperation and Farmers Welfare. Directorate of Economics and Statistics.
6. Singh ISP. 1995. Effect of various doses of nitrogen on seed yield and quality of okra. *Annuals of Agricultural - Research* 16(2): 227-229.
7. Mishra TS, Singh HM, Mishra US, Mishra NK. 2019. Integrated management of late blight diseases of potato crop grown in Northern India. *International Journal of Recent Scientific Research* 10(6B): 32786-32791.
8. Luthra SK, Gupta VK, Lal M, Rawal S, Kumar V, Singh BP, Mohan K. 2017. A new high yielding table potato variety. *Potato Journal* 44(1): 65-73.
9. Chaudhary RA, Akram M, Gill KH, Qazi MA. 2001. Zinc requirement of potato crop in the Punjab. *Pakistan Journal of Soil Science* 19(1/2): 81-83.
10. Kamalnathan S, Sunderajan S, Thamburaj S. 1970. Studies on optimum spacing and manuring for okra. *Madras Agric. Research* 12: 213-228.
11. Abbasi FF, Baloch MA, Zia-ul-Hassan Wagan KH, Shah AN, Rajpar I. 2010. Growth and yield of okra under foliar application of some new multi-nutrient fertilizer products. *Pakistan Journal of Agriculture, Agricultural Engineering and Veterinary Sciences* 26(2): 11-18.
12. Sharma RP, Datt N, Chander G. 2009. Effect of vermicompost, FYM and chemical fertilizers on yield, nutrient uptake and soil fertility in okra [*Abelmoschus esculentus* (L.) Moench] – Onion (*Allium cepa*) sequence in wet temperate zone of Himachal Pradesh. *Journal of Indian Society of soil Science* 57(3): 357-361.