__Original Research Article__

Response of organic and inorganic nutrient sources on soil nutrient status of cucumber production under protected cultivation

Abstract:

A study was conducted at Hi-Tech Unit, Department of Horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur during 2017 and 2018 to evaluate the effect of different nutrient sources on post harvest soil fertility status in cucumber under Naturally Ventilated Polyhouse**.** The present study comprises eight treatment combinations with four replications under completely randomized design. From the study, it was found that application of 50% organic management through innovative approaches and 50 % RDF through organic fertilizers resulted in maximum production of cucumber and maximum uptake of macro nutrients by the cucumber plants. It is also confirmed that integrated application of different nutrient sources improved the post harvest soil fertility status for next crop with sustainable soil and environment health.

Keywords:- Cucumber, Protected cultivation, Nutrient uptake, Organic manures

Introduction:

Cucumber (*Cucumis sativus* L.) is one of the most popular and widely grown vegetable all over the India. It belongs to the family cucurbitaceae which comprises of 117 genera and 825 species in warmer parts of the world (Gopalakrishnan, 2007). It is one of the quickest maturing vine vegetable crop and widely grown throughout the country. The immature fruits of is said to have cooling effect, prevent constipation and indigestion. It is one of the most important crop and popular among polyhpouse growers due to early production and high profitability (Ameta *et al.*, 2019)

With the changing scenario, polyhouse production of cucumber emphasizes the need of chemical fertilizers no doubt have played a significant role in providing nutrients for intensive crop production but increased use of chemical fertilizers in green house an unbalanced manner has created problem of nutrient deficiencies, diminishing soil fertility, ground water pollution and unsustainable crop yields (Chatterjee and Bandyopadhyay, 2014). For suitable yield supply of balanced nutrition to the plant having the entire essential nutrient element, which would be possible by adopting integrated nutrient management. Integrated nutrient management system refers to the balanced use of chemical fertilizers in combination with organic manures, crop residues, bio fertilizers and other biological sources. (Thriveni *et al.,* 2015) However, considering the recent concept of eco-friendly production under green house, the use of cost effective and eco-friendly organic manures and biofertilizers with suitable integration of inorganic fertilizers restores the soil health while keeping the soil productive and sustainable with quality produce under protected conditions This approach of nutrient management under polyhouse condition aims at efficient and judicious use of optimum combination of organic, inorganic and biological nutrient sources.

Materials and methods:

An experiment was carried out at Hi-tech Unit, Department of Horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur during two consecutive years 2017 and 2018, to assess the effect of various organic manures, chemical fertilizers and biofertilizers on nitrogen, phosphorus and potash availability of soil after cucumber production under naturally ventilated polyhouse. The experiment was laid out in completely randomized design with eight treatment combinations replicated four times. The treatments involved were as follows:-

Table:1 Treatment combinations used in the study.

Notation	Treatments
T_1	100 per cent RDF (Inorganic source)
T_2	100 per cent RDF+ biofertilizers
T_3	100 per cent vermicompost + biofertilizers
T_4	100 per cent vermicompost
T_5	100 per cent Organic Management (1/3 of RDN by NADEP compost + 1/3 by vermicompost + 1/3 by non-edible cakes + biofertilizers)
T_6	75 % Organic Management (1/3 of RDN by NADEP compost + 1/3 by vermicompost + 1/3 by non-edible cakes + biofertilizers) + innovative practices (BD 500 @ 75 g per hectare before sowing and 20 DAS + BD-501 @ 2.5 g per hectare 2-4 leaf stage + mataka khad 10 per cent at 20 DAP + Panchagavya @ 10 per cent 20 DAS
T_7	50 per cent Organic Management (1/3 of RDN by NADEP compost + 1/3 by vermicompost + 1/3 by non-edible cakes + biofertilizers)+ 50 per cent inorganic fertilizers
T_8	75 per cent Organic Management (1/3 of RDN by NADEP compost + 1/3 by vermicompost + 1/3 by non-edible cakes + *Azotobacter*, integrated crop management) + 25 per cent inorganic fertilizers

The raised beds of 1 meter width having 45 cm above from ground level along with length of polyhouse were prepared the plot size was 7 m X 1 m and spacing was followed 45 cm X 30 cm. Basal dose of NADEP compost, vermi-compost, and non-edible cakes were calculated as per treatment and thoroughly mixed in the soil one week before sowing. Bio-fertilizers (PSB + ZSB + *Azotobector*) @ 4 kg per ha were inoculated and applied one week after sowing. Fertigation schedule was followed and NPK was applied in liquid form along with irrigation water twice in a week as water soluble NPK mixture (19:19:19) and (0:52:34) along with micronutrient and calcium nitrate. All cultural practices were followed regularly during entire crop growth period and observations were recorded for available nitrogen, phosphorus and potash after and before completion of experiment. The data was analyzed statistically following the method of Panse and Sukhatme (1985).

Result and discussion:-

During recent years, organic manures in vegetable production become very popular among the farmers due to the improvement in quality and taste of the produce along with sustainable production maintaining soil health in the economically sound manner.

The results of soil nutrient analysis after completion of experiment in cucumber revealed that available N, P and K content of soil influenced significantly by various applications of organic and inorganic fertilizers. Maximum available nitrogen (223.31 kg/ha) and maximum available potassium content (311.49 kg/ha) after completion of experiment in cucumber were recorded with treatment T_2 (100 % RDF + biofertilizers) while, maximum available phosphorus content (26.34 kg/ha) was recorded with T_1 (100 % RDF alone), whereas minimum available nitrogen (191.96 kg/ha) was recorded for treatment T_4 (100 % vermicompost alone), minimum available phosphorus content (21.00 kg/ha) was recorded with treatment T_6 (75 % organic management) and minimum available potassium content (270.77 kg/ha) with treatment T_3 (100 % vermicompost + biofertilizers).The application with 50% organic and 50% inorganic fertilizers (T_7) resulted in maximum yield during both the year of experiment and available nitrogen (213.20 kg/ha), available phosphorus content (23.32 kg/ha) and available potassium content (273.09 kg/ha). The increase of nitrogen, phosphorus and potassium content uptake appeared to be more obvious when the inorganic fertilizers mixed with the organic manures and biofertilizers as compared to application 100 % RDF and other without combination based treatments. Mahmoud *et al.,* (2009) also reported that combination of organic and inorganic fertilizers could increase yield and soil fertility in cucumber.

Higher amount of available NPK in soil with chemically treated plots as compared to combined application or organic manures might be due to poor soil physical structure and lack of microbial activity thus resulting in poor utilization of NPK as such treatments left over higher residual of these nutrients. Lower amount of available NPK was recorded with high yielding treatments and individual application of organic manure might be due to proper utilization and absorption. Similar findings were also reported by Kanaujia and Daniel (2016) who reported that high residues of nitrogen in application of 100 per cent RDF in cucumber. Similar findings were also revealed by Chatterjee and Bandyopadhyay (2014) in tomato, Anjanappa *et al.* (2012), Bindiya *et al.* (2014) in cucumber and Tuti *et al.* (2014) in pepper under naturally ventilated polyhouse condition.

Conclusion:- Based on the findings of present study it may be concluded that Judicious integration of 50 % organic and 50 % RDF inorganic fertilizers, containing biofertilizers proved its superiority for better production, sustainability and fertilizer use efficiency.

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Table:-2 Initial fertility status of experimental soil.

S.No.	Soil properties	Content	Method of analysis	References
1.	Organic carbon %	0.57	Rapid titration method	Walkley and Black (1947)
2.	Available nitrogen (kg ha^{-1})	224	Alkaline $KMnO_4$ method	Subbiah and Asija (1956)
3.	Available phosphorus (kg ha^{-1})	29	Olsen's method	Olsen *et al.* (1954)
4.	Available potassium (kg ha^{-1})	297	Flame photometer method	Richards (1968)
5.	pH	7.8	Electronic glass electrode method	Piper (1950)
6.	EC (dsm)	1.7	EC meter	

Table:3 Effect of different integrated nutrient levels on yield, available nitrogen, available phosphorus and available potash in soil.

Treatments	Available nitrogen in soil (kg/ha)			Available phosphorus in (soil kg/ha)			Available potash in soil (kg/ha)			Yield per meter square (kg)		
	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled
T_1	218.55	220.36	219.46	26.35	26.32	26.34	304.55	306.41	305.48	11.14	11.40	11.27
T_2	220.97	225.65	223.31	27.45	22.71	25.08	312.93	310.04	311.49	11.65	11.50	11.57
T_3	223.54	200.83	212.19	26.12	24.63	25.38	280.63	260.90	270.77	8.96	9.26	9.11
T_4	196.56	187.36	191.96	24.85	20.27	22.56	284.09	278.39	281.24	8.53	8.21	8.37
T_5	204.24	190.42	197.33	25.79	22.43	24.11	280.14	272.37	276.26	9.97	10.13	10.05
T_6	208.49	189.08	198.79	23.91	18.10	21.01	278.66	263.40	271.03	8.29	8.14	8.21
T_7	220.65	205.74	213.20	24.28	22.36	23.32	275.49	270.69	273.09	12.78	12.91	12.85
T_8	216.28	192.08	204.18	23.06	18.94	21.00	289.74	278.31	284.03	11.95	12.55	12.25
SEm±	6.66	6.28	4.85	0.77	0.67	0.54	8.89	8.67	6.57	0.17	0.20	0.14
CD 5%	NS	18.33	13.80	2.25	1.97	1.54	NS	25.31	18.68	0.51	0.59	0.41