Effect of integrated nutrient management on growth parameters of okra [*Abelmoschus esculentus* (L.) Moench.] variety Parbhani Kranti under south eastern plain zone V of Rajasthan.

Abstract

The present investigation was carried out to observed effects of different organic manures (vermicompost, neem cake and farm yard manure) along with RDF either alone or in various combinations on growth and growth parameters of okra. The experiments were conducted at the Instructional farm, School of Agricultural Sciences, CPU Kota during Kharifseason of 2019 and 2020. Days to 50% germination, days to 100% germination, plant height, stem diameter, number of branches per plant, number of leaves per plant, number of nodes per plantand days to first flowering were calculated for each treatment including control (no manure). Results revealed the maximum growth was obtained if 140% RDF and vermicompost were applied together. In the experiments, it was also found that on this combination, the earliest and the fastest germination and growth, and development was obtained which was highly significant than control or treatment with single manure.

Keywords: organic manures, RDF,growth, growth parametersetc.

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1. Introduction

Abelmoschusesculentus L.(belongs to family Malvaceae) is commonly known as Okra, Bhindi or lady's finger having 130 diploid chromosomes. It is one of the important crops among the vegetable and grown in many countries and distributed from Africa to Asia, Southern Europe and America. It is considered to be an important vegetable crop cultivated almost across the country under various agro-climatic conditions. Several species of the genus *Abelmoschus* are grown in various part of the world among them *Abelmoschus esculentus* L. is mostly cultivated in Asia and has a great commercial demand due to its nutritional values. India produces okra i.e., 6371000 MT with an area of 519000 ha **(NHB, 2019).**

The soils of Rajasthan varied from light to heavy in texture with high pH and low nitrogen content. The application of nitrogen is quite essential for proper growth and development of plants **(Ansari and Sukhraj, 2010).**

The fertilizers show significant effects on crops by fulfilling their nutrient requirement. Persistent nutrient depletion is posing a greater threat to the sustainable agriculture. The application of chemical fertilizer to the crops involves high cost. However, organic manuresobtained from waste are cheaper and renewable sources that contributes for the development strategies which do not lead to rise in consumption of non-renewable forms of energy **(Subba Rao, 1974).**

So, it is required to replace inorganic fertilizers by organic waste to improve growth and growth parameters of a crop. The aforesaid consequences have way to grow okra using different organic sources and bio fertilizers, use of organic manure in combination with chemical fertilizers that helps in improving physio-chemical properties of soil structure, water holding capacity and soil aeration, chemical properties and supply of essential nutrients in balanced ratio, supply of nutrients, slow release of nutrients, of the soil flora and fauna.

Organic waste from different sources provides nutrient to a crop and enhance growth and growth parameters as it contains most of the essential nutrients for plant growth and development hence, it responds well to the application of both organic manures and inorganic fertilizers. The bio fertilizers are gaining importance due to their low cost, non- residual toxicity and capacity to enrich soil fertility in addition to high returns under favorable conditions. Organic manures are known to supply the macro

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More compact, scientific and concise writing

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Comment [u8]: Organic and chemical fertilization is required to meet the high yield potential of crops (Zargarshooshtari et al., 2020; Serri et al., 2021). Nevertheless, nitrogen is the most needed mineral nutrients to be applied in cropping systems, mainly due to its high solubility and mobility in the soil (AghayeNoroozlo et al., 2019; Souri and Aslani, 2018; Souri et al., 2017).

1.Serri, F., Souri, M.K. and Rezapanah, M., 2021. Growth, biochemical quality and antioxidant capacity of coriander leaves under organic and inorganic fertilization programs. Chemical and Biological Technologies in Agriculture, 8(1), pp.1-8.
2.ZargarShooshtari, F., Souri, M.K., Hasandokht, M.R. and KalateJari, S., 2020. Glycine mitigates fertilizer requirements of agricultural crops: case study with cucumber as a high fertilizer demanding crop. Chemical and Biological Technologies in Agriculture, 7(1), pp.1-10.

3.AghayeNoroozlo Y., Souri, M.K. and Delshad, M., 2019. Effects of foliar application of glycine and glutamine amino acids on growth and quality of sweet basil. *Advances in Horticultural Science*, *33*(4), pp.495-501.
4.Souri, M.K. and Aslani, M. (2018). Beneficial effects of foliar application of organic chelate fertilizers on French bean production under field conditions in a calcareous soil. Adv. Hort. Sci., 2018 32(2): 265-272.
5.Souri, M.K., Sooraki, F.Y. and Moghadamyar, M., (2017). Growth and quality of cucumber, tomato, and green bean under foliar and soil applications of an aminochelate fertilizer. Hortic. Environ. Biotechnol., 58(6), pp.530-536.

Comment [u9]: Continious cultivation, harvesting and soil nutrient depletion can significantly reduce the soil productivity is no compensating measure is taken (Souri and Hatamian, 2019).

1.Souri, M.K. and Hatamian, M. (2019). Aminochelates in plant nutrition; a review. J of Plant Nutrition, 42 (1): 67-78.

Comment [u10]: Why this old reference? There are thousands of new more related !!!!!

Comment [u11]: Chemical fertilizers by organic fertilizers that are more sustainable and environmental friendly (Souri, 2016).

1.Souri, M.K., (2016). Aminochelate fertilizers: the new approach to the old problem; a review. Open Agriculture, 1: 118-123.

and micronutrients, apart from improving soil properties and fertility. However, much information is not available on use of inorganic fertilizers in combination with organic manures and biofertilizers in okra seed production. Therefore, there is a need to work on the requirement of inorganic fertilizers in combination with organic manures and biofertilizers for suitable increased in seed yield and quality of okra **(Akbasova*et. al*., 2015).**

In the present investigation, we applied different organic manures i.e. vermicompost, neem cake, and farm yard manure (FYM) with recommended daily fertilizers (RDF) alone or in different combination to observe their effects of growth and growth parameters on Okra.

2. Materials and methods

2.1 Experimental Site

The experiment was conducted at the Instructional farm, School of Agricultural Sciences, CPU Kota during Kharif season of 2019 and 2020. The site is situated in humid south eastern plain zone V *of* Rajasthan and covers geographical area of 26.43 lakh hectare that represents 7.71 per cent of the total geographical area of the state. The Rajasthan state lies between $23^0 3'$ and $36^0 12'$ N latitude, $78^0 17'$ E longitude in which Kota falls between $25^0 11'$N latitude and $75^0 54'$E longitude at 273-meter altitude from mean sea level (MSL) with an average rain fall ranging from 650 mm to 1000 mm annually. The area under cultivation is about 18.0 lakh hectares, out of which approximately 26% is under irrigated and remaining area is under rain fed and dry land conditions. It includes all tehsils of Kota, Bundi, Baran, Jhalawar and part of Sawai Modhopur districts.

2.2 Climate and weather conditions

This zone possesses typically sub-tropical climatic conditions characterized by mild winters and moderate summers associated with high relative humidity during the months of July to September. The annual rainfall of the region is 650 – 1000 mm, most of which is contributed by south west monsoon from July to September.

2.3 Detailed Methodology

The detailed information about experiment is given in table 1.

Table 1: Detailed Methodology

Location	Agriculture Research Farm, CPU Kota	**Year**	Kharif 2019 & Kharif 2020

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Gross plot size (m^2)	3.6m x2.1m =7.56m^2 12Rows of 14 plant each (168 plant/plot)	**Total number of plots**	20 x 3 =60
Net plot size (m^2)	3.0mx1.8m=5.40m^2 10Rows of 12 plant each. (120plant/plot)	**Area required (m^2)**	7.5 m2 x60=453.60 m^2
Spacing (cm.)	30.00 cm x 15.00cm	**30% Extra area required (m^2)**	453.6m^2 x0.3=136.08 m^2
Treatment	Eight (8)	**Total area (m^2)**	589.68 m^2
Replication & Statistical design	Three (3) & RBD	**Crop**	Okra
Date of sowing	20 July in kharif 2019 and 25 July in Kharif 2020	**Variety**	**Parbhani Kranti**
Seed rate (kg/ha)	12.0-15.0kg/ha	**Vermicompost(t/ha)**	2.0
Date of picking	As and when required	**FYM (t/ha)**	25.0
Fertilizers NPK (kg/ha)	120:60:60 kg/ha respectively	**Neem cake (t/ha)**	3.0

2.4 Fertilizer application

Details of application of fertilizers are shown in Table 2.

In RDF, the 50% nitrogen and full dose of phosphorus and potash was applied as a basal and remaining 50% dose of nitrogen was given at 30-35 days after sowing. Organic manure was applied about 15 days prior to sowing. Organic and inorganic fertilizer was applied as per given standard procedure. FYM @ 18.9kg/plot (for 7.56 m^2 area) for all FYM treatment. Vermicompost@1.59kg/plot(for7.56m^2area) for all vermicompost. treatment. Neemcake @ 2.268kg/plot (for 7.56 m^2 area) for all neem cake treatment.

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Table 2: Details of Treatment with their quantity for (7.56 m^2) plot area

S.N.	Treatment	Quantity required
T1	Absolute Control	No fertilizer & No manure

T2	RDF	NPK @120:60:60kg/ha Urea-157.0g. DAP- 97.6g MOP- 95.0g//plot
T3	FYM	@25 t/ha i.e., 18.9kg/plot
T4	Vermicompost	@2 t/ha i.e., 1.519kg/plot
T5	Neem Cake	@3t/ha i.e., 2.268kg/plot
T6	60%RDF+FYM	NPK @72:36:36kg/ha+25t/ha Urea-94.2g, DAP-58.56g & MOP-45.0g//plot + 18.90Kg FYM
T7	80%RDF+FYM	NPK @96:48:48kg/ha+25t/ha Urea-125.6g, DAP-78.08g & MOP- 60.0g//plot + 18.90Kg FYM
T8	100%RDF+FYM	NPK @120:60:60kg/ha+25t/ha Urea-157.0g, DAP-97.6g & MOP-95.0g//plot + 18.90Kg FYM
T9	120%RDF+FYM	NPK @144:72:72kg/ha+25t/ha Urea-188.40g, DAP-117.12g & MOP-90.0g//plot + 18.90Kg FYM
T10	140%RDF+FYM	NPK @168:84:84kg/ha+25t/ha Urea-219.8g, DAP-136.64g & MOP-105.0g//plot + 18.90Kg FYM
T11	60%RDF+Vermicompost	NPK @72:36:36kg/ha+2 t/ha Urea-94.2g, DAP-58.56g & MOP-45.0g//plot + 1.519Kg VC
T12	80%RDF+Vermicompost	NPK @96:48:48kg/ha +2 t/ha Urea- 125.6g, DAP-78.08g & MOP- 60.0 g//plot + 1.519Kg VC
T13	100%RDF+Vermicompot	NPK @120:60:60kg/ha+2 t/ha Urea-157.0g, DAP- 97.6g & MOP- 95.0g//plot + 1.519Kg VC
T14	120%RDF+ Vermicompost	NPK@144:72:72kg/ha+2t/ha Urea-188.40g, DAP-117.12g & MOP-90.0g/plot + 1.519Kg VC

T15	140%RDF+ Vermicompost	NPK @168:84:84kg/ha+2t/ha Urea-219.8g, DAP-136.64g & MOP-105.0g/plot + 1.519Kg VC
T16	60%RDF+ Neem Cake	NPK @72:36:36kg/ha+ 3t/ha Urea- 94.2g, DAP-58.56g & MOP-45.0g/plot + 2.268Kg NC
T17	80%RDF+Neem Cake	NPK @96:48:48kg/ha+ 3t/ha Urea-125.6g, DAP- 78.08g & MOP- 60.0 g/plot + 2.268Kg NC
T18	100%RDF+ Neem Cake	NPK @120:60:60kg/ha+ 3t/ha Urea-157.0g, DAP- 97.6g & MOP- 95.0g/plot + 2.268Kg NC
T19	120%RDF+ Neem Cake	NPK @144:72:72kg/ha+ 3t/ha Urea-188.40g, DAP-117.12g & MOP- 90.0g/plot + 2.268Kg NC
T20	140%RDF+ Neem Cake	NPK @168:84:84kg/ha+ 3t/ha Urea-219.8g, DAP-136.64g & MOP- 105.0g/plot + 2.268Kg NC

FYM= Farm yard manure, **V.C**= Vermicompost, **N.C**= Neem cake

2.5 Details of nutrients available in urea DAP and MOP in (%)

In urea, 46.0% N was found. In DAP, 18.0% N and 46.0% P were present while in MOP, 60% K was recorded.

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4. Results

4.1: Average days to 50% germination:

The minimum days required to take 50% germination was recorded from the date of sowing. Treatment RDF, FYM, Vermicompost and Neemcake alone were statistically similar to each other but were found superior to absolute control (T-1) however, among treatments, treatment (T-15) i.e., 140% RDF+ Vermicompost @2t/ha was found statistically superior than any of the treatment or its combination including absolute control (T-1) where nothing was applied during both the season & year. The minimum (4.76 days), (5.15days) and (4.95days) required to germinate 50% seed followed by treatment T-14 (5.54days) and T-12 (5.60 days) but these two treatments were statistically at par to each other during both the season and year however,

similar result and trend was also observed in pooled mean treatment T-15 (Table 3and Figure 1)

Days to 100% germination:

The minimum days required to take 100% germination was observed from the date of sowing. Among treatment, treatment (T-15) i.e. 140% RDF+ Vermicompost @2t/ha was statistically superior than any of the treatment or its combination including absolute control (T-1) where nothing was applied .The minimum (9.30 days & 9.10days) required to germinate 100% seed with treatment (T-15) followed by treatment T-14 (10.07days, 10.30days and 10.18 days) and T-12 (11.50 days, 11.70days&12.10 days) but were statistically at par during both the season The similar result and trend was however, also observed in pooled mean treatment T-15 (Table 3 and Figure 1).

Plant height (cm.):

The initially five plants were selected and tagged randomly in each treatment and replication for observation at 90 days after sowing. The average height was then measured and calculated with the help of measuring scale on the tagged five plants in each treatment and replication for further computation.

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Result revealed (Table3 and Figure 1) that maximum plant height (100.23 cm, 100.90 cm and 100.57cm) was recorded at 90 DAS with the treatment (T-15) i.e., 140% RDF+ Vermicompost @ 2t/ha was applied which was found superior to any of the treatment or its combination including RDF and absolute control (T-1) where nothing was applied. On the other hand, minimum plant height (78.13cm, 78.47cm, and 78.30cm.) was however, recorded where nothing was applied (absolute control T-1) during both the season and year, however, plant height was statistically non-significant during both the season and year.

Stem diameter (cm)

Stem diameter was recorded with the help of virneer calipers on five tagged plants in each treatment and replication at three portions of plant i.e., top, mid and lower part of stem. The average stem diameters were then calculated in five tagged plants at each portion (Table 3 and Figure 1). Significantly maximum stem girth (2.75cm, 2.82cmand 2.78cm) was recorded with treatment (T-15) i.e., 140% RDF+ Vermicompost @2t/ha which was statistically superior to rest of the treatment or its combination including RDF and absolute control (T-1)

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where nothing was given to the plot during both the season and year. However, on the other hand, minimum stem girth (1.69cm, 1.65cm. and 1.67 cm.) was observed in absolute control (T-1). The similar result and trend were also with the pooled mean of the same treatment (T-15).

Number of branches per plant

The significantly maximum pooled (5.66) number of branches per plant was recorded with the same treatment i.e., treatment (T-15) where 140% RDF+ Vermicompost was applied when compared with any of the treatment or its combinations including RDF and absolute control (T-1) during both the season and years (Table-4 and Figure 2) however, minimum number of branches (3.81) per plant was recorded with the control (T-1). The pooled mean also represents the same trend as it was reported in both the consecutive season and year.

6 Number of leaves per plant at 90 DAS:

The significant variation was observed due to treatments (Table4 and Figure 2). The number of leaves per plant was recorded significantly maximum (50.23 leaves, 51.23 leaves & 50.73leaves) were recorded with the treatment (T-15) where 140% RDF+ Vermicompost @2t/ha was applied and when compared with any of the treatment including its combinations along with RDF and absolute control (T-1) during both the season and years followed by treatment T-11 where (47.33 leaves, 47.67 and 47.50 leaves) and treatment T-10 (46.65 leaves, 46.98 leaves and 46.81leaves) were observed but were both the treatment ie.T-11 and T-12 were statistically at par however, absolute control (T-1) had significantly minimum leaves (32.10leaves, 32.43 leaves and 32.27 leaves) per plant.

Number of nodes per plant at 90 DAS:

The data on number of nodes per plant as influenced by the application of organic, inorganic and their combinations are presented (Table4 and Figure 2). It is evident from the table that node/plant were found significantly maximum per plant (19.90, 20.57 and 20.23) with the treatment (T-15) where 140% RDF+Vermicompost@2t/ha was applied, followed by treatment T-14, T-16, T-17, T-18, T-19 and T-20 but these treatments were at par to each other during both successive seasons and year. The minimum number of node/plants was however, recorded (12.70, 12.03 and 12.36) in treatment (T-1) i.e., absolute control.

Days to first flowering:

The minimum days required to first flowering was recorded from the date of sowing. The data showed (Table4 and Figure 2) that minimum number of day taken to first flower appearance was observed in the treatment, (T-15) where 140% RDF+Vermicompost@2t/ha was applied followed by treatment (T-14) but these treatments were similar to each other in the year Kharif 2019 however, it differs in the Kharif 2020. Among treatment, Treatment (T-15) was the best which took the minimum days to first flower (39.67 days and 39.33 days) when compared with any other treatment or their combination including RDF and absolute control (T-1) which took maximum days (46.73 days) to first flower appearance during both the season and year. However, days to first flower appearance was found statistically non-significant in both the season and year. However, days to first flower appearance was found statistically non-significant. kharif 2019 and kharif 2020.

Table 3: Effects of different fertilizers on growth parameters in Okra.

Treatment	Days to 50% germination			Days to 100% germination			Plant height (cm)			Stem diameter (cm)		
	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean
T1	8.11	9.16	8.64	15.50	14.10	14.80	78.13	78.47	78.30	1.69	1.65	1.67
T2	6.96	7.76	7.36	13.50	12.00	12.75	87.00	87.33	87.17	1.74	1.81	1.77
T3	6.41	6.67	6.54	12.90	11.50	12.20	92.23	92.90	92.57	1.80	1.83	1.82
T4	6.21	6.42	6.32	13.70	12.80	13.25	90.43	90.77	90.60	1.74	1.77	1.76
T5	6.22	7.01	6.62	12.40	11.30	11.85	95.33	96.00	95.67	2.11	2.14	2.13
T6	6.03	6.33	6.18	13.20	11.00	12.10	97.90	98.90	98.40	2.12	2.15	2.14
T7	6.90	6.25	6.58	12.70	11.80	12.25	92.67	93.67	93.17	1.42	1.45	1.44
T8	5.75	6.59	6.17	11.70	10.50	11.10	93.67	94.67	94.17	2.19	2.12	2.16
T9	6.31	6.01	6.16	11.50	10.60	11.05	97.37	94.67	94.17	2.24	2.27	2.26
T10	6.43	7.77	7.10	12.50	11.70	12.10	92.82	95.82	94.32	2.00	2.07	2.03
T11	6.73	5.31	6.02	11.90	10.60	11.25	95.57	96.23	95.90	2.17	2.14	2.15
T12	5.46	5.73	5.60	11.80	10.50	11.15	96.33	97.00	96.87	2.38	2.41	2.40
T13	6.98	6.07	6.52	12.10	11.40	11.75	95.43	96.77	96.10	2.34	2.31	2.32
T14	5.54	5.54	5.54	10.07	10.30	10.18	97.33	98.67	98.00	2.47	2.50	2.49
T15	4.76	5.15	4.95	9.30	9.10	9.20	100.23	100.90	100.57	2.75	2.82	2.78
T16	6.18	6.30	6.24	11.60	10.80	11.20	96.53	97.20	96.87	2.40	2.40	2.40

T17	6.55	9.16	7.86	12.70	14.81	13.75	92.12	92.80	92.47	1.80	1.87	1.83
T18	6.05	6.28	6.17	13.50	13.24	13.37	92.33	93.00	92.67	1.90	1.93	1.92
T19	5.75	6.11	5.93	13.00	12.97	12.99	92.23	94.23	93.23	1.70	1.63	1.67

Treatment	**Number of branches/plants**	**Number of leaves/plants**	**Number of nodes/plants**	**Days to first flowering**

T20	6.15	6.21	6.18	12.30	13.25	12.77	89.77	92.43	91.10	2.10	2.07	2.08
CD (P= 0.05)	1.049	1.003	1.265	1.793	1.685	1.43	NS	NS	NS	0.3	0.303	0.069
SEm	0.365	0.349	0.424	0.624	0.586	0.48	1.44	1.538	0.367	0.104	0.105	0.023
SED	0.516	0.494	0.600	0.882	0.829	0.678	2.037	2.175	0.519	0.148	0.149	0.033

	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean	2019	2020	Mean
T1	3.78	3.85	3.81	32.10	32.43	32.27	12.70	12.03	12.36	45.90	47.57	46.73
T2	4.06	4.09	4.08	37.21	37.54	37.38	13.60	13.93	13.77	45.73	45.40	45.56
T3	4.08	4.11	4.10	38.00	38.67	38.33	13.20	13.53	13.37	45.67	46.00	45.84
T4	4.01	3.98	3.99	35.10	35.43	35.27	12.41	12.74	12.58	45.85	46.18	46.02
T5	4.08	4.15	4.11	42.00	42.33	42.17	15.44	15.77	15.61	45.20	46.20	45.70
T6	4.03	3.96	4.00	40.90	41.23	41.07	16.23	16.56	16.40	44.90	45.23	45.07
T7	4.02	4.05	4.04	38.30	38.63	38.47	14.30	14.63	14.47	45.42	45.75	45.59
T8	4.01	4.08	4.04	41.03	42.03	41.53	18.40	18.73	18.57	43.50	43.83	43.67
T9	4.14	4.21	4.17	46.00	46.33	46.17	18.31	18.98	18.64	43.00	43.67	43.33
T10	4.14	4.24	4.19	46.65	46.98	46.81	14.35	15.35	14.85	45.08	46.41	45.75
T11	4.70	4.73	4.72	47.33	47.67	47.50	17.12	17.45	17.29	44.20	44.87	44.53
T12	4.76	4.66	4.71	44.10	44.43	44.27	17.31	17.64	17.48	44.07	44.74	44.40
T13	4.54	4.51	4.52	43.75	44.42	44.09	16.29	16.96	16.62	44.67	45.34	45.00
T14	4.94	4.91	4.92	46.10	46.43	46.27	19.13	19.46	19.30	41.43	42.10	41.77
T15	5.61	5.71	5.66	50.23	51.23	50.73	19.90	20.57	20.23	39.67	39.33	39.50
T16	4.84	4.87	4.86	43.90	44.23	44.07	18.67	19.00	18.84	43.10	43.86	43.52
T17	4.20	4.27	4.23	45.93	46.27	46.10	18.21	18.88	18.54	44.90	45.90	45.40
T18	4.00	4.03	4.02	42.70	43.03	42.87	18.00	18.67	18.33	44.35	45.02	44.68
T19	4.10	4.13	4.12	42.10	42.77	42.43	18.60	18.93	18.77	45.23	45.90	45.56
T20	4.30	4.33	4.32	43.20	43.53	43.37	18.80	19.47	19.13	44.65	44.98	44.82
CD (P= 0.05)	0.622	0.601	0.08	3.652	3.689	0.324	2.358	2.312	0.297	NS	NS	NS
SEm	0.216	0.209	0.027	1.271	1.284	0.109	0.82	0.804	0.1	2.302	2.21	0.236
SED	0.306	0.296	0.038	1.797	1.815	0.154	1.16	1.137	0.141	3.255	3.125	0.333

Table 4: Effects of different fertilizers on growth and growth parameters in Okra.

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But for Figs should be under the Fig.

5. Discussion

Comment [u18]: Not still in scientific format

Needs to be improved

Make a continuous and interrelated explanation of the events and why you received such results.

To obtain better growth and yield of a crop, optimum fertilizer should be used in suitable combinations with optimum dose. Overuse of fertilizers might be harmful for a crop. Different organic fertilizers provide different nutrients for a crop. This study was conducted to know the effects of organic fertilizers (either alone or in combination) on growth and growth parameters of okra.

In our study, lowest days to seed germination, highest plant height and stem diameter, maximum number of branches, leaves, nodes per plant and the lowest days to first flowering were found when 140% RDF and vermicompost@2t/ha were used together. Our findings are in accordance with results of studies by**Mohammadi, G. *et. al.*, (2012), Meena *et. al*., (2018), Paravatham*et. al.*, (1989), Das, A.K. *et. al*., (2014) and Khan, H. *et. al*., (2000).**

Singh, N.P., (1979) also reported that application of nitrogen @ 0.0, 75.0 and 150.0 kg/ha, phosphorous and potash @ 0.0, 60.0 and 120.0 kg/ha in okra variety PusaSawani at IIVR Varanasi (UP). He noticed that application of nitrogen and phosphorous @ 75.0 kg/ha and 60.0 kg/ha respectively gave maximum value in number of branches, plant height, fruit and size of fruit with minimum number days taken to first flowering. However, Potassium alone could not show any significant effect. His finding also confirmed this experimental finding.

Result obtained in this experiment had close conformity with the findings of **Miglani, A. *et al.*, (2017)** when he applied bioagents in combination with nitrogen that showed and confirms the application of Azospirillum to seed +30.0kg nitrogen/ha gave highest growth and yield in okra variety PusaSawani. It is now clear that application of organic, inorganic and bio agent have synergetic effect on physiological parameter including yields as well. **Bhushan *et.al*., (2013)** also confirms the results of present research finding and they also reported that the effect of Azotobactor and inorganic fertilizers on growth, development and yields of okra var. HissarUnnut.

Results revealed that days to 50% germination, days to 100% germination, plant height, stem diameter, number of leaves per plant, number of branches per plant, number of nodes per plant, days to first flowering were better with combination of 140% RDF+Vermicompost@2t/ha which was significantly higher than control and other plants which were treated with single fertilizer. Results of the current study strongly suggest that growth and development of okra can be enhanced by combined use of organic fertilizers in their optimum ration. Similar kinds of results were also shown by **Akter*et. al*., (1993).** They also found that combination of different manures and fertilizers significantly enhance growth and yield parameters in comparison to using fertilizer/manure alone. It has also been cleared by other scientists also that the combined application of organic manures and inorganic fertilizers is highly beneficial for sustainability in crop production **(Khan, A.R. *et. al*., 2001; Liu *et. al*., 1990).** Supplying different fertilizers together increases the quantity the quality of a variety of nutrients simultaneously and can reduce the amount of N loss **(Kramer *et al*., 2002).**

Myint*et. al*., (2011) suggested that the main advantage of using organic manures was to provide plants with nutrients that are released slowly throughout the growing season. Uses of waste as manure cut the investment cost for a crop.

6. Conclusion

Comment [u19]: Make it better

By results of the present investigation, it can be concluded that use of 140% RDF and vermicompost together can give better growth and development of okra and farmers can get more economic return by using this combination.

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