International Journal of Agriculture Sciences
ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 10, Issue 10, 2018, pp.-6111-6112.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

STUDIES ON THE EFFECT OF ORGANIC MANURES AND INORGANIC NITROGEN ON GROWTH AND YIELD OF KALE (*Brassica oleracea var. acephala*)

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Received: May 14, 2018; Revised: May 26, 2018; Accepted: May 27, 2018; Published: May 30, 2018

Abstract: A field experiment was conducted in the year 2010 and 2011 at SKUAST- K, Shalimar campus in complete randomized block design with three replications and sixteen treatments to study the effect of organic manures and inorganic nitrogen on growth and yield of kale *var. acephala*. Maximum improvement in plant height, plant spread, number of leaves and leaf weight per plant, weight of whole plant and leaf yield per hectare was recorded when 45 t FYM ha^{-1} along with 135 kg N ha^{-1} gave significantly higher growth and yield attributes but was at par with $F_{30}N_{90}$.

Keywords: *Kale, organic manure, fertilizers, yield, growth*

Citation: Fozia Qureshi and Uzma Bashir (2018) Studies on the Effect of Organic Manures and Inorganic Nitrogen on Growth and Yield of Kale (*Brassica oleracea var. acephala*). International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 10, Issue 10, pp.- 6111-6112.

Academic Editor / Reviewer: Dr V. Sri Latha

Introduction

Kale (*Brassica oleracea L. var. acephala*) is a very versatile and nutritious green leafy vegetable, belonging to the Brassicaceae family. Kale is closer to than most domesticated forms of Brassica oleracea [7]. Kale was known to the ancient Greeks and several cultivars were described by Cato around 200 B.C. Kale is a minor temperate vegetable introduced in India in 19th century, it is cultivated on commercial scale and is very rare in India. This leafy vegetable is cultivated for its low fat, no cholesterol but health benefiting antioxidant rich green. Kale is notably good in many vitamins (mainly vitamin C, E and K) micronutrients (iron, zinc and manganese) and macronutrients (calcium and magnesium) dietry, fibre, glutamine (an amino acid with anti-inflammatory properties) and plant phytochemicals like polyphenol, flavonoids and carotenes [8]. The everyday consumption of leafy vegetables lowers risk of cancer and heart diseases, prevents tiredness, helps keeping well condition, and prevents senescence [1]. In India, it is commercially grown in Kashmir and to a limited extent in Jammu regions, Assam, and Himachal Pradesh. In Jammu and Kashmir, it is popular vegetable grown in almost all kitchen garden and commercial crop around cities and towns. Its cultivation has picked up around metropolitan cities due to increased demand in hotels. The production potential of kale can be realized by using high yield varieties, improved cultural practices, viable agricultural technology, and judicious plant protection measures. Plant nutrition are the most important factors influencing growth and yield of kale. Therefore, this study examined the performance of kale with different levels of farmyard manure and inorganic nitrogen.

Materials and Methods

The experiment was conducted during 2010 and 2011 in experimental farm of Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar main campus, Srinagar. The soil of the experimental plot was silt clay loam in texture having available nitrogen, phosphorus, and potassium contents of 232.50, 19.25 and 212.20 kg ha^{-1}, respectively, with pH of 6.97. The net plot size was and planting was done at a spacing of 30 x15 cm. The experiment was laid out in a factorial randomized block design with 48 treatment combinations comprising of 4 levels of FYM (0, 15, 30 and 45 t ha^{-1}) and four levels of nitrogen (0, 45, 90 and 135 kg ha^{-1}) each replicated thrice. The farmyard manure was applied as per treatments 15 days prior to transplanting. Full quantity of P and K applied uniformly to plots as per package of practice and half dose of N applied to each plot as per treatment. Remaining dose of N was applied after 30 days of transplanting. Proper care of irrigation, weeding- cum- hoeing and plant protection measures were taken during entire period of crop growth. The observation on growth, yield and yield attributes were recorded and analyzed statistically as suggested by Gomez and Gomez [4].

Results and Discussion

The results revealed that the plant height , plant spread and number of leaves recorded at harvest was maximum in treatment $F_{45}N_{135}$ and was on par with treatment $F_{30}N_{90}$ in both the years [Table-1].The beneficial effect of application of organic manures along with inorganic fertilizers in increasing the growth of plant can be attributed to the synergistic effect of organic manures in making available more plant nutrients by improving the soil physical condition and solubilizing the nutrients in soil. Moreover, the organic manures are also significant sources of major and micronutrients much needed by the plants. Similar increase in plant growth due to organic manure application was noticed by Sahu, *et al* [4]. Significantly higher leaf weight plant^{-1}, weight of whole plant and leaf yield of kale was recorded in treatment combination $F_{45}N_{135}$ which differed significantly with all the other treatments [Table-2] but was at par with $F_{30}N_{90}$. This could be due to balanced C/N ratio, more organic matter build up, enhanced microbial activity, improvement in soil properties, better root proliferation, availability and accelerated transport and higher concentration of plant nutrients. All these might have accelerated metabolical activities, leading to better photo syntheses and efficient translocation of photosynthates from sink to sources, resulting in improvement of leaf yield and its related attributes. The results are in line with the findings of Shisong, [5] and Shree, *et al*. [6]. In conclusion the overall results suggest that an application of FYM at 30 t ha^{-1} with 90 kg N ha^{-1} produced higher growth and yield attributes of kale.

Table-1 Effect of organic manure and inorganic nitrogen of kale *var. acepahla*

Treatments	Plant Height (cm)		Plant Spread (cm)		No of leaves /plant	
F_0N_0	35.23	35.01	40.02	38.92	9.05	8.98
F_0N_{45}	39.45	40.78	47.95	48.38	10.58	10.32
F_0N_{90}	43.00	44.87	51.87	52.64	12.21	12.12
F_0N_{135}	46.44	47.70	54.75	56.12	13.66	13.47
$F_{15}N_0$	37.39	37.87	41.10	42.84	9.56	9.58
$F_{15}N_{45}$	43.73	44.44	50.27	51.82	12.65	12.94
$F_{15}N_{90}$	46.21	46.02	54.87	55.96	13.52	13.52
$F_{15}N_{135}$	48.60	49.25	57.03	57.60	13.93	14.08
$F_{30}N_0$	38.01	39.05	42.87	43.94	9.91	9.90
$F_{30}N_{45}$	45.09	46.12	52.57	53.57	13.23	13.63
$F_{30}N_{90}$	49.98	50.76	58.87	59.96	14.95	15.05
$F_{30}N_{135}$	50.85	51.78	59.98	60.96	15.28	15.42
F_{45} N_0	40.54	40.65	43.95	45.87	10.31	10.58
F_{45} N_{45}	47.12	48.03	56.73	56.98	13.90	14.04
$F_{45}N_{90}$	50.43	51.40	59.46	60.64	15.11	15.28
$F_{45}N_{135}$	51.11	52.01	60.37	61.25	15.80	15.93
CD(p≤0.05)	1.15	1.27	1.60	1.72	0.84	0.89

Table-2 Effect of organic manure and inorganic nitrogen on yield of kale *var. acephala*

Treatments	Leaf yield plant^{-1} (g)		Weight of whole plant (g)		Leaf yield (q ha^{-1})	
	2010	2011	2010	2011	2010	2011
F_0N_0	162.50	159.50	182.69	178.21	325.00	319.00
F_0N_{45}	198.63	194.04	241.47	239.04	397.25	388.07
F_0N_{90}	236.83	238.80	288.23	291.45	473.65	477.59
F_0N_{135}	268.80	271.29	329.01	329.83	537.60	542.57
$F_{15}N_0$	177.38	174.51	207.72	206.58	354.75	349.01
$F_{15}N_{45}$	247.95	253.53	295.49	302.09	495.89	507.05
$F_{15}N_{90}$	268.40	268.17	323.83	324.04	536.80	536.33
$F_{15}N_{135}$	277.06	192.06	335.54	346.38	557.12	572.76
$F_{30}N_0$	194.38	264.17	229.38	229.49	388.75	384.11
$F_{30}N_{45}$	257.11	299.66	308.10	314.29	514.22	528.34
$F_{30}N_{90}$	292.06	309.66	355.08	365.09	584.12	599.32
$F_{30}N_{135}$	299.08	309.667	365.79	375.89	603.57	619.32
F_{45} N_0	224.13	226.54	265.34	270.07	448.25	453.08
F_{45} N_{45}	278.56	280.06	330.48	337.15	554.12	560.12
$F_{45}N_{90}$	310.79	306.22	362.58	375.20	598.15	612.44
$F_{45}N_{135}$	304.58	312.11	371.58	382.54	609.15	624.21
CD(p≤0.05)	12.61	12.81	16.80	17.62	25.12	26.05

Application of research: Both organic and inorganic nitrogenous fertilizers provide plants with nutrients needed to grow, healthy and strong. However, each contains different ingredients and supplied these nutrients in different ways. Organic fertilizers worth over time to create a healthy growing environment while inorganic fertilizers provide rapid nutrients. Determining which is better for your plant depends largely on the needs of plant and preference in terms of cost and environment input.

Research Category: Organic manure

Abbreviations:
FYM- Farm Yard Manure, F=Organic manure, N- Nitrogen, P- phosphorus, K. potassium, B: C- Benefit: Cost

Acknowledgement / Funding: Author thankful to Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar, 190025, J&K, India

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Research project name or number: Response of kale Brassica oleracea var acephla to different levels of farm yard manure and inorganic nitrogen on yield, quality and nutrient accumulation under eutrochepts.

Author Contributions: All author equally contributed

Author statement: All authors read, reviewed, agree and approved the final manuscript

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

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