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Response of different combinations of organic manures and bio-fertilizers on growth and yield of kale Cv. Gurez local (Siberian kale) under high altitude climatic conditions of Gurez-J&K

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Abstract

A field experiment was conducted at experimental farm of Mountain Agriculture Research & Extension Station Gurez, SKUAST-K (J&K) with six treatments of combinations of different sources of organic manures along with bio-fertilizers (Azotobactor + Phosphate solublizing bacteria) during kharif -2020 to find out the response of different sources of organic manures and bio-fertilizers for improving growth and yield attributes of Kale (Siberian kale) under high altitude rain fed climatic conditions. Among the treatments studied, significantly highest plant height (45.66 cm), No. of leaves/plant (17.66), plant spread /plant (44.33 cm), weight of leaves /plant (335.00 g), yield /plot(9.38 kg) and yield /hectare 208.44 q, were noticed with the application of poultry manure @100% recommended dose 5 tonnes/hectare along with azotobactor and phosphate solublizing bacteria.

Keywords: Azotobactor, bio-fertilizer, organic manures, PSB, siberian kale

Introduction

Kale (*Brassica oleracea* L.Var. *acephala*) belongs to the family *Brassicaceae*. There are various types of kale, but curly-leaved types are grown for human consumption. Kale is closely related to the wild cabbage and most forms bear a rosette of leaves at the top of the stem. Kale can tolerate temperatures as low as minus 15°C and can sustain high temperatures as well. Kale is a rich source of vitamin C, provitamin A, and calcium. (Kalloo, 1993) [5]. Kale is a biennial closely related to the cabbage, grown as an annual for its edible shoots and young leaves. It is probably originated along with varieties of the species in Western Europe, but is now widely distributed throughout the world. There are two main groups of kale, the curly-leaved types referred to as Scotch kales or borecole, and the broader, smooth leaved types. Rape or Siberian kales are similar to the curly-leaved kales but belong to the species *Brassica napus* (Fordham and Hadley, 2003) [4]. Siberian kale is a different species from other varieties, resembles more in rutabegas, rapeseeds and certain types of turnip and is more cold hardy, resistant to diseases and pest than other kale varieties. Siberian kale develops a sweeter flavor as the temperature drops and exposure to frost. Siberian kale is rich in carotenoid which helps to enhance the body's absorption of carotenoids and other fat-soluble nutrients. Siberian kale also contains glucosinolates which have shown to aid in liver detoxification.

The use of organic materials as fertilizers for crop production has recently received attention for sustainable crop productivity (Tejada *et al.*, 2009) [13]. Organic materials hold great promise as a source of multiple nutrients and ability to improve soil characteristics (Moller, 2009) [6]. Use of organic manures along with bio-fertilizers is not only helpful in improving soil health, growth, yield and quality but also avoids chemical based farming (e and Bhamare, 2007) [10]. Organically grown foods are more healthier and contains minerals and vitamins than conventional crops (Bahadur *et al.* 2004) [3] and also improve keeping quality both at room temperature and in storage (Umlong, 2010) [14]. Organic manures helps to increase the population of soil micro-organisms which influence in protecting plant against pathogen like nematodes and soil borne insects and also provide growth hormones like auxin (Agbedge and Ojeniyi, 2009) [2]. Keeping in view, the importance of nutritional rich leafy vegetable in high altitude region, an experiment was carried out to find out the response of different sources of organic manures and bio-fertilizers for improving growth and yield attributes of Kale (Siberian kale) under high altitude rain fed climatic conditions.

Material and Methods

The experiment was conducted at experimental farm of Mountain Agriculture Research and Extension Station, Gurez, SKUAST-K during kharief-2020 in randomized complete block design (RCBD) with six treatments (T₁-FarmYardManure@ 100% RD25 t ha⁻¹+AZB+PSB, T₂-PoultryManure @100%RD 5 t ha⁻¹+AZB+PSB tonnes, T₃-SheepManure @100%RD 20 t ha⁻¹+AZB+PSB, T₄-Horse Manure @100%RD 25 t ha⁻¹+AZB+PSB, T₅-Forest litter @100%RD 25 t ha⁻¹+AZB+PSB and T₆ control) during kharif -2020, replicated three times. Gurez is an area located at an altitude of (8000-11000 ft above msl) in the northern areas of Jammu and Kashmir Union Territory. The soil has pH 7.0, E.C 0.85dsm1, OC 0.51%, avg. N 340 kg/ha, avg. P 35 kg/ha, avg. K 230kg/ha. The seedlings of Kale var. Gurez local were transplanted in plots of 3.0 × 1.5 m size at a spacing of 30 × 30 cm in the 1st week of June. The sources of different organic manures tried in experiment were applied at the time of land preparation. All recommended cultural practices were adopted to raise the crop. Observations on various growth and yield related attributes were recorded; using standard procedures. The data thus collected was subjected to analysis of variance, using the method proposed by Panse and Sukhatme (1978) [9].

Results and Discussion

Growth and Yield Parameters

It is evident from the data presented in Table 1, that there were significant variations among treatments tried in experiment related to growth and yield related attributes of Kale. Among different treatments, T₂- poultry manure @5

tonnes per hectare along with bio-fertilizers azotobactor and Phosphate solublizing bacteria registered highest plant height (45.66cm), number of leaves per plant (17.66), plant spread per plant (44.33cm), weight of leaves per plant (335.00 g), yield per plot (9.38 kg) and yield per hectare (208.44 q) followed by T₃ and T₁ was found statistically significant as compared to rest of the treatments. The improvement of growth and yield parameters of Kale might be due to the combined application of different organic manures and bio-fertilizers that influenced the physical and chemical properties of soil and easy availability of macro and micro nutrients, increase in enzymatic activities leading to better growth and development. Similar results were reported by Singh *et al.*, 2009 [12]; and Sharma, 2011 [11]. The Superiority of poultry manure over rest of the treatments tried in experiment in improvement of growth and yield of kale can be attributes to its nutritional richness, quick mineralization, balanced C/N, more availability of nitrogen and other plant nutrients. Besides this, poultry manure contains uric acid having 60 per cent nitrogen, which gets readily available to plants. In addition to these qualities, it is an excellent source of organic matter and contains growth promoting substances, synergistic interaction with bio-fertilizers, efficient microbial activity leading to sustainable nutrient availability and improvement in soil physical conditions. All these might have led to better root proliferation, better translocation of plant nutrients and accelerated carbohydrate synthesis, finally leading to better growth and yield. Similar results were reported by Abusaleha and Sahanmugavelu, 1988 [1], Naidu *et al.*, 2000 [7], Bahadur *et al.*, 2004 [3] and Narayan *et al.*, 2004 [8].

Table 1: Effect of different sources of organic manures and Bio-fertilizers on growth and yield of Siberian kale

Treatments	Pl.ht (c.m)	No. of leav/plant	Pl. spread (cm)	wt. leaves /pl(g)	Yld/plot (kg)	Yld/ha (q)
T ₁ -FarmYard.Manure @100% R.D (25 t ha ⁻¹) +AZB+PSB	36.66	15.33	32.66	260.00	7.28	161.77
T ₂ -PoultryManure@100% R.D (5 t ha ⁻¹) +AZB+PSB	45.66	17.66	44.33	335.00	9.38	208.44
T ₃ -SheepManure@100% R.D (20 t ha ⁻¹) +AZB+PSB	41.33	13.00	38.00	301.66	8.44	187.70
T ₄ -HorseM anure@100% R.D (25 t ha ⁻¹) +AZB+PSB	30.33	8.00	26.00	195.00	5.46	121.33
T ₅ -Forest litter@100% R.D 25 t ha ⁻¹ +AZB+PSB	34.33	10.66	29.00	223.33	6.25	138.95
T ₆ -Control	25.00	6.00	20.50	126.66	3.54	78.80
C.D(P≤0.05)	1.95	1.60	2.71	16.62	0.46	10.34
C.V	2.97	7.38	4.74	3.75	3.75	3.75

Conclusion

From the present investigation, it is concluded that application of 5 tonnes Poultry Manure ha⁻¹ along with bio-fertilizers (azotobactor and Phosphate solublizing bacteria) is adequate for maximum growth and yield attributes of Kale (Siberian Kale) in the study location.

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