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Efficacy of graded levels of nitrogen and potassium on growth and yield of watermelon (*Citrullus lanatus*) in lateritic soils of Konkan

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Abstract
A field experiment was conducted to evaluate the effect of nitrogen, phoporous and potassium on growth and yield parameters of watermelon crop in lateritic soils of Konkan region. The experiment was carried out in a Randomized Block Design (RCBD) with three treatments replicated seven times. Experimental results revealed that mean fruit yield of different treatments was significant during individual years as well as in pooled data among the different fertilizer levels tested. The treatment T_3 (20t FYM, 250-50-100 kg NPKha^{-1}) produced maximum fruit yield (30.45 tha^{-1}) (Pooled data) which was significantly superior over all other treatments whereas the treatment T_1 20t FYM, 150-50-50 kg NPKha^{-1} (RDF) recorded minimum fruit yield of 22.96 tha^{-1}. T_3 also showed that application of increased level of nitrogen along with rational increased dose of potassium significantly increased the average weight of fruits, number of fruits per vine and ultimately the yield of watermelon crop that shows positive response of the crop toward the graded levels of fertilizers. Treatment T_3 (20t FYM, 250-50-100 kg NPK ha^{-1}) showed best results and was thus optimum fertilizer dose for lateritic soils of Konkan region of Maharashtra

Keywords: Watermelon, fertilizers, growth, yield and Konkan region

1. Introduction
Water melon (*Citrullus lanatus*) belonging to family Cucurbitaceae is most commonly grown in the middle East, the United States of America, Africa, India, Japan and Europe. It is one of the most widely cultivated crops in the world. Its global consumption is greater than that of any of the cucurbit family member (FAO, 2007). It accounts for 6.8% of the world area devoted to vegetable production (Guner *et al*. 2004, Goreta *et al.* 2005) [7, 6]. Plant growth is favoured by high temperature and adequate sunlight. Watermelon is a very common summer cucurbit grown from the lower Himalayan region to South India. It is also cultivated in riverbed and supplied to the markets before the hot summer starts throughout the country.

Fruits make a delicious and refreshing dessert, especially esteemed in hot weather. The pulp of the fully ripe fruit is juicy, sweet and delicious. The agro-climatic conditions of the Konkan region are suitable for commercial cultivation of watermelon. It is consider as one of the most important vegetable crop in Konkan region as it is greatly demanded by local market and distant market at metropolitan cities like Mumbai and Pune. Previously the farmers of this region were growing the traditional and straight varieties but now a day, they are shifted to the hybrids for getting maximum yield with better quality.

The hybrid requires the extra nutrition for getting maximum yield. One of the major challenges currently facing watermelon farmers is low yields and poor quality due to heavy or low fertilization especially of nitrogen (HCDA. 2006) [8]. Nitrogen fertilization when applied at correct rates increases vegetative growth and hence high yields and quality (Waseem *et al*. 2008) [21]. However no systematic research work with regards to the nutrition management in watermelon hybrids for konkan region has been conducted. It is grown immediately after harvesting of rice crop occupying prominent position in rice based cropping system in most of the part of Konkan region and can fetch better price in market. By considering these facts the experiment was conducted to standardize the fertilizer dose in hybrid watermelon.

2. Materials and Methods

A field experiment was conducted with application of N @ 150, 200 and 250 kg ha^{-1}, constant levels of P @ 50 kg ha^{-1} and K @ 50, 75 and 100 kg ha^{-1} in Randomized Block Design comprising three treatments with seven replications at Vegetable Improvement Scheme, Central Experiment Station, Wakawali, Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, Tal. Dapoli, Dist. Ratnagiri during *Rabi* season of *2012*-13, 2013-14 and 2014-15. The effect of application of graded levels of N, P and K were studied on the parameters *viz*. number of days to 50% flowering, vine length, number of fruits per vine, days to first harvest, fruit length, fruit girth and weight of fruits at harvest. These treatment effects were tested on *Augusta* hybrid of watermelon crop which was spaced at a distance of 1.50m x 0.50m.

2.1 Treatment Details

T1 - 20t FYM, 150-50-50 kg NPKha^{-1} (RDF)
T2 - 20t FYM, 200-50-75 kg NPKha^{-1}
T3 - 20t FYM, 250-50-100 kg NPKha^{-1}

3. Results and Discussion

The growth and yield attributing characters *viz.* Days to 50% flowering, vine length, number of fruits $vine^{-1}$, days to first harvest, fruit length (cm), fruit girth (cm), fruit weight (Kg) and yield (tha^{-1}) were recorded. Results indicated that number of fruits $vine^{-1}$, fruit weight, and yield were significantly affected due to application of different levels of nitrogen, phosphorous and potassium. Parameters viz. days to 50% flowering, vine length, number of fruits per vine, days to first harvest, fruit length, fruit girth depicted non significant variation (Table1.) significant yield attributing characters are summarized below.

3.1 Average weight of fruits (kg.)

The average weight of the fruits is one of the most vital yield attributing character of watermelon crop. From the Table 1, it is clear that the average weight of fruit increased with application of increased levels of nitrogen and potassium doses. It is evident that the treatment T_3 receiving 250:50:100 N: P: K kg ha^{-1} showed higher weight of fruit (3.19 kg) which was significantly superior over the control (RDF) (2.79 kg). The treatment T_2 was significantly higher over control and remained at par with the treatment T_3.

Nitrogen is known to promote vegetative growth (Elmstrom, 1973a) [4]. More leaves translate to better chlorophyll development and higher stomatal conductance hence enhanced photosynthesis. This therefore leads to more photosynthates being manufactured. It is therefore possible that more photosynthates were translocated to the sinks leading to earlier maturity of watermelon fruits, more and heavier fruits subsequently leading to higher yield (Maluki *et al.* 2016) [14].

Similar trend of results are in conformity with Bhosale (2017) [2], Sawaratkar (2014) [20] for the *var*. Augasta. Okur and Yagmur (2004) [17] showed parallel results in watermelon that highest fruit weight (4.63 kg) was obtained by application of 120:80:240 kg N: P_2O_5: K_2O ha^{-1} along with micronutrients. Increased average weight of fruit (3.27 kg) in watermelon was also reported by Kolekar *et al.* (2013) [13] and Maluki *et al.* (2016) [14].

3.2 Number of fruits per vine

The significant variation for number of fruits per vine was observed with response to the application of graded levels of nitrogen and potassium to the watermelon crop. The treatment T_1 (control) showed lowest number of fruits 1.69 while T_3 receiving 250:50:100 N: P: K: kg ha^{-1} was extensively better with 1.99 fruits per vine. Treatment T_2 (1.80) was found at par with the T_3. Maluki *et al*. (2016) [14] found that increased levels of nitrogen resulted in improved sex ratio i.e. more number of female flowers as compared with male flowers. This could be the reason for higher female flowers and ultimately more number of fruits per vine. Sabo *et al*. (2013) [18] also reported similar trend with interaction effect of fertilizer doses and spacing. Inamdar (2009) [10] also showed similar trend in watermelon.

3.3 Yield of fruit (t ha^{-1})

Application of N, P and K fertilizer had significant effect on watermelon yield (Table 2). During three consecutive years, N applied at the rate of 250 Kg Nha^{-1} yielded more followed by 200 Kg Nha^{-1} while the lowest yield was recorded under the control (150 Kg Nha^{-1}). It clearly shows that fruit yield was significantly affected due to different levels of nitrogen as well as potassium. Treatment T_3 (20t FYM, 250-50-100 kg NPK ha^{-1}) was found to be having maximum yield in three years i.e. 2013, 2014 and 2015 (i.e. 29.23, 34.29 and 27.84 t ha^{-1}) respectively. This increment is associated with more number of fruits per vine and maximum fruit weight.

Higher yields results can be attributed to the role of nitrogen in creating plant fresh, dry matter and energy-rich compounds which regulates photosynthesis (Hochmuth *et al*. 1994) [9]. Okur and Yagmur (2004) [17], Sabo *et al*. (2013) [18] and Maluki *et al*. (2016) [14] reported that yield of watermelon was increased with the increasing potassium dose. Oga (2015) [11] also observed increased yield due to increased level of nitrogen along with different staking treatments. A significant treatment effect on the fruit yield t ha^{-1} showed that a higher yield of watermelon could be achieved by increasing and fertilizer rates. This finding agrees with the findings of (Nesmith 1993, Dithie *et al.*. 1999, Sander *et al*. 1999, Motsenbocker and Aracilria 2000, Goreta *et al.* 2005, Andranda Junior *et al.* 2006) [16, 3, 19, 15, 6, 1] who noted that the Watermelon production increased with the application of Nitrogen fertilizer. Kappel (2013) [12] also depicted that increased level of potassium increased yield level in Crisby watermelon.

Table 1: Effect of different fertilizer levels on growth parameters of watermelon.

Sr. No	Treatment	50% flowering (Days)	Vine length (m)	No. of fruits/vine	Days to first harvest	Fruit length (cm)	Fruit girth (cm)	Fruit weight (Kg)
1.	T_1 (20t FYM, 150-50-50 kg NPKha^{-1} (RDF)	37.71	2.87	1.69	77.86	20.15	58.83	2.79
2.	T_2 (20t FYM, 200-50-75 kg NPKha^{-1})	38.43	2.95	1.80	77.57	20.76	60.40	2.97
3.	T_3 (20t FYM, 250-50-100 kg NPKha^{-1})	38.57	3.12	1.99	75.29	21.91	61.20	3.19
SE $\pm$		0.30	0.06	0.06	0.88	1.21	0.71	0.10
CD at 5%		NS	NS	0.18	NS	NS	NS	0.30

Table 2: Effect of different fertilizer levels on yield (tha^{-1}) of watermelon.

Sr. No	Treatments	Average fruit yield (tha^{-1})			Pooled mean (tha^{-1})
		2013	2014	2015	
1.	T_1 (20t FYM, 150-50-50 kg $NPKha^{-1}$ (RDF)	23.92	23.73	21.22	22.96
2.	T_2 (20t FYM, 200-50-75 kg $NPKha^{-1}$)	26.66	28.48	23.82	26.32
3.	T_3 (20t FYM, 250-50-100 kg $NPKha^{-1}$)	29.23	34.29	27.84	30.45
SE +		0.582	2.46	1.63	1.56
CD at 5%		1.815	7.59	5.03	4.81

4. Conclusions

From the above discussions, it could be concluded that there was a significant increase in number of fruits of watermelon as well as yield as a result of NPK fertilizer application. Considering this appreciable positive influence by the application of $N:P_2O_5:K_2O$ @ 250:50:100 kg ha^{-1} i.e. treatment T_3 was found statistically superior over all the treatments as compared to treatment T_1 and T_2. Following this, NPK fertilizer @ 250:50:100 kg ha^{-1} was recommended to farmers in the study area for a more profitable production of watermelon.

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