INDIAN JOURNAL OF
ARID HORTICULTURE
2016, Vol. 11 (1-2):42-46

Effect of different levels of NPK on yield and yield attributes of water melon (*Citrullus lanatus* Thunb.)

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(Received: 27.12.2014; Accepted: 12.08.2016)

Abstract

An investigation was carried out to study the effect of different levels of NPK on fruit yield and yield attributes of watermelon. The treatments studied were T_1 (50 kg N, 35 kg P_2O_5, 50 kg K_2O), T_2 (60 kg N, 40 kg P_2O_5, 60 kg K_2O), T_3 (70 kg N, 45 kg P_2O_5, 70 kg K_2O), T_4 (80 kg N, 50 kg P_2O_5, 80 kg K_2O), T_5 (90 kg N, 55kg P_2O_5, 90 kg K_2O),T_6 (100 kg N, 60 kg P_2O_5, 100kg K_2O) and a control without fertilizer application (T_7) which were replicated three times. The result of the study revealed that the yield and yield attributing characters of watermelon were significantly affected by the different treatments tested. The treatment T_5 produced significantly the highest 35.77 t/ha fruit yield while control plant produced the lowest fruit yield 8.64 t/ha and also it was superior over other treatments in term of number of female flower/vine (14.50), fruit diameter (22.49 cm), Flesh thickness (19.75 cm), Flesh to rind ratio (2.99), Fruit dry weight (1144.80 g) /vine, Biological yield (1638.30g), Harvest Index (69.88%) and total sugar content of the fruit (7.62 %). Therefore, the T_5 with 90:55:90 kg NPK /ha could be suggested as the optimum fertilizer dose for maximizing yield and its attributes of watermelon variety sugar Baby for agro-climatic condition of Assam.

Key words: Fertilizer dose, Yield, Harvest Index, Flesh to Rind ratio, Watermelon

Introduction

Watermelon (*Citrullus lanatus* L.) is a member of the family cucurbitaceae, kingdom : plantae, order : cucurbitales, Genus : citrullus and species : lanatus (Wikipedia, 2013). It refers to both fruit and plant of vine like (Climber or trailer) herb (Thulaja, 2005). Watermelons are rich in water and as such are helpful in preventing dehydration. The low calorie content of the fruits makes it a best choice for diet conscious people (Sonia, 2013). The seeds are rich in fat and protein and are eaten as snacks added to other dishes or used as oil seed. The rind of watermelon is often pickled and the fruits are cooked as a vegetable when immature while the mature fruit when flesh turn red is eaten in raw (Maitra, 2007). The crop growth and yield performance of watermelon is influenced by a number of factors like soil, climate, manures & fertilizers, irrigation, control of pests, diseases, weeds etc of which the application of fertilizers under intensive system of cultivation is identified as the single most important factor controlling the yield optimization. Since farm yard manure or compost alone cannot suffice the entire nutrient requirement of the crop to maintain adequate growth performance through out the life cycle which is otherwise the key requirement for a profitable farming system, hence the plants often suffer from hidden hunger of major plant nutrients like nitrogen, phosphorus and potash. As such direct application of nitrogen, phosphorus and potash appears to be the prime requirement for maximizing plant growth rate and there by to increase the biological yield so as to hold maximum economic yield with better fruit quality. The doze, time and method of NPK fertilizer application must be optimum to make it as profitable venture under the prevailing agro-climatic condition of this region of the country where the watermelon might appear as one of the most important fruit vegetable crop of the summer season. However, at present the crop is cultivated in meager areas mainly because of lack of the proper cultivation practices of the crop suitable for this region. Therefore, the present study was undertaken to find out the most suitable combination of NPK for the agro-climatic condition of Assam for watermelon (*Citrullus lanatus* Thunb.) so that the grower can harvest the maximum yield with better fruit quality.

Materials and methods

The investigation was conducted during 2009-10 in the Experimental Orchard, Department of Horticulture, Assam Agricultural University, Jorhat, Assam. The soil of the plots was sandy loam with p^H 6.5 and available soil nitrogen, phosphorus and potassium were 295.00, 40.82 and 114.05 kg/ha, respectively. The experiment comprising seven treatments was laid out in Randomized Block Design with three replications. The plot size of 6m X 4m were prepared and seeds of watermelon variety *Sugar baby* were sown in the month of February at a spacing of 2m X 2m accommodating 6 plants in each plot. Different fertilizer treatments were applied as basal as well as 30 days after sowing as per different treatment combinations. The seven different treatments tested were T_1 (50,35,50 : NPK kg/ha), T_2 (60,40,60 : NPK kg/ha),T_3 (70,45,70 : NPK kg/ha), T_4 (80,50,80 : NPK kg/ha), T_5 (90,55,90 : NPK kg/ha),T_6 (100,60,100 : NPK kg/ha) and T_7 (control). Fifty percent of nitrogen in the form of urea, full dose of phosphorus in the form of single super phosphate and full dose of potassium in the form of muriate of potash were applied as per the treatment at the time of sowing which were then mixed and covered with soil. The remaining 50 % of nitrogen was applied in soil at 30 days after sowing. All other recommended package of practices was followed. The data in respect to crop growth, yield attributing characters and quality of fruit were recorded which were then statistically analyzed for the test of significance following the method of Ponse and Sukhatme (1995).

Results and Discussion

The Table-1 revealed a gradual increase in the number of days required to first harvest the watermelon fruits with the increase in fertilizer doses and treatment T_6 plants with highest fertilizer dose took the significantly longest 91.65 days period as compared to control plants which needed the shortest 86.00 days period for the same. All other treatment took the period in between these two extreme, however failed to differ significantly from control. The higher dose of nutrient specially the nitrogen might help the plant to continue vegetative growth for longer period by altering the C: N ratio and delayed the reproductive phase and harvesting maturity of fruits. Similar findings were also reported by Kumar *et al.* (2003) & Pandey *et al.* (1996) in different vegetable crops from different parts of the world.

The male flower number per vine of watermelon significantly differed in different treatment combinations and the highest 154.33 male flower number per vine was recorded in T_3 which was at par with T_5 (152.11) while the control plants produced the significantly lowest 120.45 male flower number per vine. Similarly, Table-1 showed a significant variation of female flower number per vine of watermelon under different treatments. The T_5 plants recorded the significantly highest 14.50 female flower number per vine which was at par with T_6 (13.65), in contrast the control plants maintained the significantly lowest 8.55 female flower number per vine. In general an increasing trend of both male and female flower number per vine of watermelon was observed with the increase in fertilizer doze. This might be due to the principle that higher fertilizer doses cause more vegetative growth thereby accumulate more reserve food materials and alter C:N ratio which in turn may produce more flower particularly the female flower per vine lowering the male : female flower ratio of watermelon. A balanced nutrition is utmost necessary to maintain vigorous vegetative growth at the early stage so as to build up sufficient food materials within the plant before entering into reproductive phase and in later phase the maintenance of a proper sex ratio with higher female flower number per vine of cucurbits like watermelon is equally important to get higher fruit number per vine and total fruit yield per hectare. This finding is in close agreement with Olaniyi (2008), Hazarika *et al.* (2012), Efediyi and Samson (2009) who reported similar observations from different part of the globe in muskmelon, watermelon and cucumber.

The diameter of individual watermelon fruit was significantly affected by the present treatments and the significantly highest 22.49 cm fruit diameter was recorded in T_5 which was at par with T_6 (22.42 cm) and both were significantly superior over all other nutrient treatments (Table-1). On the other hand control plants produced the smallest fruits with 13.92 cm fruit diameter followed by T_1 with 14.93 cm diameter and they were statistically at par but significantly inferior than all other treatments. A similar trend was observed in case of flesh thickness of the fruit and the highest 19.75 cm flesh thickness was recorded in T_5 which was at par with T_6 with 19.74 cm flesh thickness while significantly lowest 10.33cm flesh thickness was recorded in control fruits. In contrast the control fruits maintained the significantly thickest 1.80 cm rind thickness followed by T_1 (1.66 cm) and T_2 (1.65 cm) and they were statistically at par but the control plants differed significantly from other treatments while T_6 plant had the smallest 1.37 cm rind thickness followed by T_5 (1.37 cm) and T_4 (1.50 cm). Due to thicker flesh and thinner rind composition the T_5 fruits were able to hold the highest flesh to rind ratio of 2.99 followed by T_6 (2.98) which were at par but significantly superior than all other treatments. The control fruits for the same reason could result the lowest ratio of 1.48 and other treatments were able to maintain significant superiority in this regard over control fruits (Table-1). The highest fruit diameter (22.49 cm), flesh thickness (19.75 cm), flesh to rind ratio (2.99) were recorded in T_5 with higher fertilizer level which may be attributed to higher photosynthetic activity for prolong period and better capacity for dry matter partitioning and assimilation of the treated plants and thereby increased the

fruit diameter, flesh thickness, flesh to rind ratio and decreased rind thickness compared to control plants. Similar results were also observed by Oloyede *et al*. (2013) in pumpkin. The result of the present study also revealed that the dry fruit yield per vine, fruit yield per hectare, vine dry weight, biological yield as well as harvest index of watermelon were significantly affected by the different fertilizer doses tested. The highest 1144.80 g dry fruit yield per vine, 35.77 t/ha fruit yield, 1638.30 g biological yield and 69.88 % harvest index were recorded in the treatment T_5 again these were the minimum in case of control except the harvest index which was minimum 57.65% in T_1. The higher fruit yield of watermelon in elevated fertilization might be due to larger size and weight of the individual fruit which in turn increased the dry yield per vine. These increased individual fruit size and fruit weight per vine in elevated fertilizers might be attributed to the ability of NPK to promote vigorous vegetative growth at initial and then final reproductive growth of watermelon by instantly supplying the necessary raw materials required for formation and development of new cells and tissues and by favouring other physiological activities relating to mobilization of more food materials to economic parts to increase harvest index. The role of fertilizer in increasing the plant vigour in the form of length and weight of vine and number and size of leaves, leaf area index, leaf chlorophyll content were well documented in many crops and these increased leaf area might carry out more photosynthesis and converted light energy to chemical energy more efficiently and thus accumulated more biomass for subsequent reproductive growth. Similar results were also observed by Olaniyi and tell (2011), Olaniyi (2000 & 2006) and Sabo *et al.* (2013) in watermelon.

The juice content of the fruit and total sugar content of the juice were also significantly affected by different treatments (Fig-1 & Fig-2). The T_5 maintained statistically significant superiority over all other treatment in these two fruit quality parameters whereas control fruits were the least performer. This might be the fact that balanced nutrition not only increase the crop growth and yield of watermelon (Hazarika *et al.* 2012) but also improve the soil physical and chemical properties (John *et al.,* 2004), thereby help the plant to sustain vigorous vegetative for prolonged period and boost up the reserved food and timely mobilize to the reproductive parts leading to more yield with better fruit quality. The positive correlation of NPK fertilization with the increasing fruit quality has also been reported by Okur & Yagmur (2004) and Hazarika *et al.* (2012) in watermelon. The present study therefore revealed that a balance fertilizer application is the utmost necessity to increase the production and productivity of watermelon as such T_5 with 90-55-90: NPK kg ha^{-1} could be suggested as the best fertilizer treatment combination for watermelon in agro climatic condition of Assam to harvest the highest fruit yield with better quality which is necessary for commercial farming.

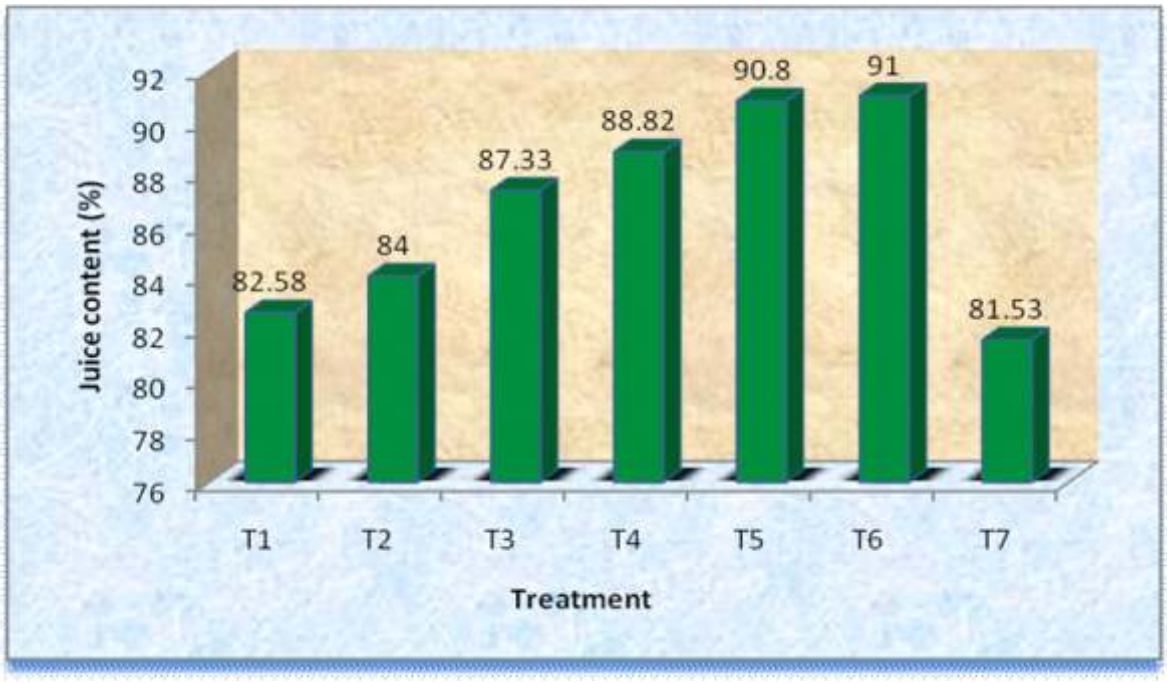

Fig 1 : Effect of different levels of NPK on Juice Content of watermelon

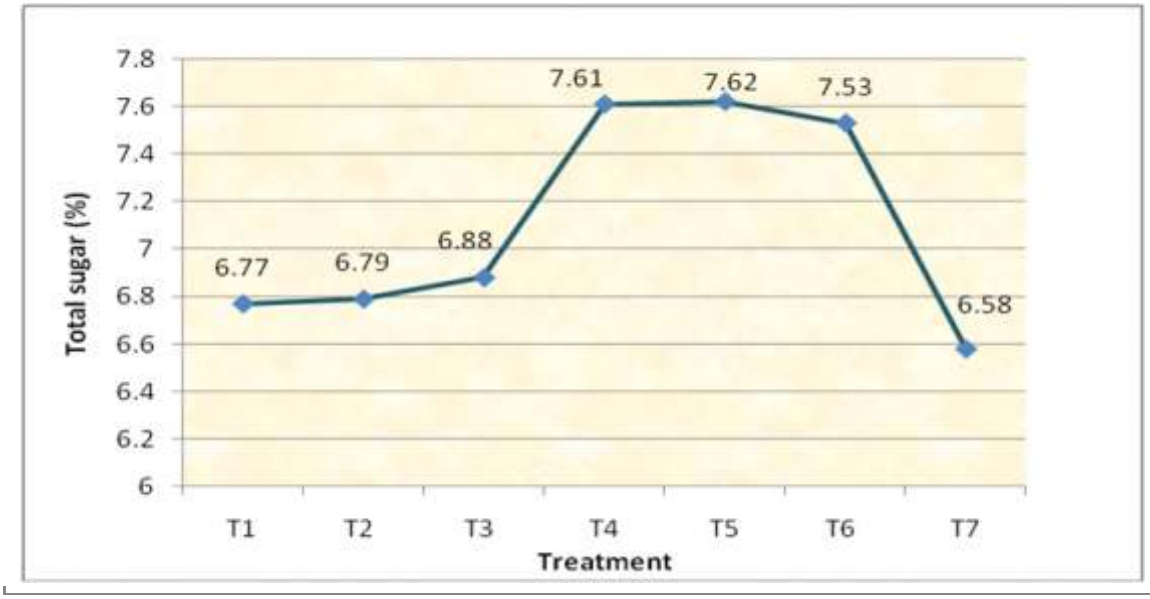

Fig 2 : Effect of different levels of NPK on Total Sugar content of watermelon

Table-1. Effect of N, P and K on yield and yield attributes of watermelon

Treatments	Days to first harvest	No. of male flower/vine	No. of female flower/vine	Fruit diameter (cm)	Flesh thickness (cm)	Rind thickness (cm)	Flesh to rind ratio	Fruit dry weight /vine (g)	Vine dry weight (g)	Biological Yield (g)	Fruit Yield (t/ha)	Harvest Index (%)
T_1	87.00	136.55	11.26	14.93	11.68	1.66	1.77	344.80	253.28	598.08	10.78	57.65
T_2	87.52	147.25	11.50	16.05	12.75	1.65	1.93	393.60	336.38	729.98	12.30	53.92
T_3	87.60	154.33	12.60	19.91	16.77	1.57	2.53	637.60	346.72	984.32	19.93	64.78
T_4	88.24	147.00	12.51	21.16	18.16	1.50	2.74	788.00	480.31	1268.31	24.63	62.13
T_5	88.70	152.11	14.50	22.49	19.75	1.37	2.99	1144.80	493.50	1638.30	35.77	69.88
T_6	91.65	147.20	13.65	22.42	19.74	1.34	2.98	1067.20	493.52	1560.70	33.35	68.39
T_7	86.00	120.45	8.55	13.92	10.33	1.80	1.48	276.80	180.18	456.98	8.64	60.57
S.Ed±	1.31	1.10	0.41	0.48	0.56	0.08	0.09	10.60	4.86	15.46	2.66	1.32
C.D (5%)	2.85	2.40	0.90	1.04	1.21	0.18	0.19	23.20	10.58	33.78	5.79	2.85

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