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# Impactof Integrated Organic Nutrient Handlingon Fruit Yields and Quality of Strawberry cv. Kurdistan in Iran

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Abstract

This study was conducted during 2008-2009 to investigate the influence of different organic nutrient combinations on yields and quality of strawberry cv. Kurdistan in Iran. The experiment comprised of five organic nutrient treatment combinations including the recommended dose of N, P and K through chemical fertilizer as control. Treatment N2 (manure + *Azotobacter* + woodash + phosphorus solubilizing bacteria + oil cake) improvedsignificantly quality of fruit about diameter (3.11cm), length (3.95 cm), volume (20.397 $cm^3$), weight (11.11g), total sugars (7.95%), total soluble solids (TSS) (9.01° Brix), acidity (0.857), TSS: acidity ratio)(11.12) and yields (238.95 g/plant).

**Keywords:** Fruit quality, Organic manure, Strawberry, Yield.

## INTRODUCTION

Modern agricultural practices mostly related on high application of mineral fertilizers to achieve high yield. It is widely recognized that application of mineral fertilizer (especially nitrogen) can causeto ground water pollution by nitrate leaching through the soil profile. Concerns about the possible consequences of using increasing amount of chemical pesticides have been led to a great interest onsubstitutive strategies to ensure competitive yields and protection of crops. The new approach to farming is often referred to as sustainable agriculture, seeks to introducefriendlier agricultural practices to the environment and maintains the long term ecological balance of the soil ecosystem. The use of microbial inoculants (bio-fertilizers) is considered as the alternative source to nourishthecrops. S Gharib *et al.* (2008) showed that the oil percentage and yield per plant have been increased as a result of aqueous extracts of compost at low level + bio-fertilizers compared with control, indicating that combinations of low input system of integrated nutrient management could be beneficial to obtain relatively good yields of essential oil. The commercial strawberry (*Fragaria× ananassa*) isfullof vitamin C. The presence of ellagic acid preventing cancer, relieves heart disease and the abundance of anthocyanins has been made it more valuable fruit. The effect of bio-inoculants on growth of strawberry "Sujatha' resulted to increase in plant height, number of leaves per plant, fresh weight, dry weight, leaf area and leaf chlorophyll content (Wasi-Amiri *et al.*, 2011). Another study by Aseri and Rao (2004) in gooseberry showed that nitrogen fixing bacteria (*Azospirillumbrasillense, Azotobacterchroococcum*) and AM-fungi have increased the plant height, leaf area and shoot dry weight and also uptake of micronutrients increased with inoculation of N2-fixers and AM-fungi individually. Ghaderi and Talaie (2008) showed that application of manure along with urea had a significant effect on total fruit yield, and prevention of weight, fruit decay as well as leaf specific mass.Fruit quality is a combination of appearance, flavor, texture and nutritional value. It is affected by pre-harvest factors such as climatic conditions and cultural methods (Licznar, 2006).Because of these, strawberry producers often use very large amounts of synthetic mineral nutrients and agrochemicals to improve yields and quality.

Present study was conducted to observe the effects of different organic nutrients combinations on quality attributes of strawberry cv.Kurdistanin Iran.

## MATERIALS AND METHODS

The experiment was carried out at experimental field of Department of Horticulture, University of Tehran, Karaj, Iran, during 2008-2009. Initial nutrient composition of soil was organic carbon (0.69%), N (334.00 kg/ha), $P_2O_5$(17.50 kg/ha) and $K_2O$ (333.50 kg/ha). The texture of the soil of the experimental field was clay loam (21.8% sand, 41.7% silt and 33.6% clay). The cultivar Kurdistan was used to evaluate the various treatments. Five treatments included $N_1$ (farmyard manure + *Azotobacter*+ phosphorus solubilizing bacteria + oil cake), $N_2$ (poultry manure + *Azotobacter*+ wood ash + phosphorus solubilizing bacteria + oil cake), $N_3$ (farmyard manure + Azospirillum+ phosphorus solubilizing bacteria + oil cake), $N_4$ (poultry manure + Azospirillum + wood ash + phosphorus solubilizing bacteria + oil cake) and N5 (recommended dose of NPK: 340:150:340 kg/ha). The nutrient composition offarmyard manure was 1% N, 0.5% P2O5 1% $K_2O$. Also,poultry manure was included 1.25% N, 1.5% $P_2O_5$ and 2.15% $K_2O$. Mustard cake contained 5.5% N, 1.75% $P_2O_5$ and 1.2% $K_2O$. Treated runners with bio-fertilizers according to respective treatments were planted at a spacing of 60cm x 30cm in a well prepared bed of 1.8$m^2$ during the month of March 2008. Runners were treated with *Azotobacter*+ phosphorus solubilizing bacteria and *Azospirillum*+ phosphorus solubilizing bacteria at the time of transplanting in 1% jaggery solutions according to the proposed treatments. At the time of calibration of nutritional requirement it was assumed that *Azotobacterand Azospirillum*would fix nitrogen at 25kg/ha. Farmyard manure and poultry manure were applied 15 days before transplanting in their respective plots while well rotten mustard cake was applied in April.

A random samples of fruits from each treatment was analyzed for fruit weight, size (diameter, length and volume) and yield per plant. Fruit length and diameter werecalculated by vernier caliper. Fruit volume was calculated by using the formula $4.189ab^2$(a = ½ length of fruit, b = ½ diameter of fruit) (Westwood, 1993). Fruit quality parameters for example total sugars were recorded as per the standard procedure. Total soluble solids were recorded using hand refractometercaliberated in°Brix. Titrable acidity was determined by N/10 NaOHusing phenolphethalein as indicator. Experimental data were statistically analyzed following the analysis of variance (Gomez and Gomez, 1984).

## RESULTS AND DISCUSSION

Physical parameters of fruit such as length, diameter and volume are given in table 1. It was found that all the parameters were significantly increased in organically treated plots as compared to plots receiving inorganic treatment. The maximum fruit length (3.95 cm), fruit diameter (3.11 cm), fruit volume (20.39 $cm^3$) and fruit weight (11.11g) were recorded with treatment $N_2$. The increase may be due to balanced availability of macro and micro nutrients and growth promoting hormones produced by different bio-fertilizers applied in different treatment combinations. This may be attributed to better fillings of fruits due to more balanced uptake of nutrients which may have lead to better metabolic activities in the plant ultimately lead to high protein and carbohydrate synthesis (Singh *et al*., 1970). Besides nitrogen fixing abilities of the microbial inoculants, the capacity to releasing phyto-hormones especially gibberellins should be regarded which increases the fruit size. Also the efficient partitioning of photosynthesis towards the sink by Azotobacterinoculation increased the fruit size and weight (Rana and Chandel, 2003). The yield attributes or the sink capacity of a crop is determined by its vegetative growth throughout the life cycle of the plant. Vigorous growth is associated with higher sink capacity of a crop. The increase in yield can be resulted from better root proliferation. In addition, increased nutrient elements in the soil enhanced uptake of nutrients and water caused to higher photosynthesis leading to an increase of the assimilation rates. The generation of $CO_2$ during compost decomposition has also been found responsible for increasing yield (Lieten, 1996).Brown *et al*.(1993) showed that Among various organic sources, poultry manure had the most important role followed by farm yard manure that is in agreement with the result of this study.

The juice content, total sugars, total soluble solids, acidity and TSS: acidity were significantly influenced by the organic nutrient application (Fig. 1). The maximum juice content (82.39%), total sugars (7.95%), total soluble solids (9.01° Brix), acidity (0.857%) and TSS:acidity ratio (11.12) were recorded with treatment $N_2$ and while the minimum were observed in treatment $N_5$. A positive relation have been found in fruit size and fruit juice content and increase in fruit size might have been due to steady balance of nutrient availability to the plant and secretion of growth promoting hormones by the applied bio-fertilizers. It has also been suggested that growth regulators increase the mobilization of carbohydrate to the developing fruit and increase berry size (Sidahmed and Kliewer, 1980). Increased TSS and total sugars at higher levels of nitrogen might have resulted due to the fact that absorption of nitrogen may have exerted regulatory role as an important constituent of endogenous factors in affecting the quality of fruit in which carbohydrate is important and during ripening of fruits the carbohydrate reserves of the roots and stem are drawn upon heavily by fruits which might have resulted into higher TSS and sugar contents in fruits. Increased TSS and total sugars in fruits are in agreement with the findings of Antipchuk *et al*.(1982) who reported that inoculation of different Azotobacterstrains to soil resulted in higher fruit sugars in tomato. The increase in acidity may be due to more balanced uptake of nutrients. Our results are in agree with findings of Prabakaran and Pichal (2003) who found increase in titrable acidity of the fruit due to the use of 100 percent nitrogen in the form of poultry manure. Maximum TSS: acidity ratio recorded in treatment $N_2$ might be due to corresponding increase in total soluble solids

and acidity. These results are in confirmation with Pereira and Mitra (1999) who reported that TSS: acidity ratio being superior with organic manure. The efficiency of poultry manure among all other organic sources was more as 90% of nitrogen in the poultry manure becomes available during first year (Mathur and Goss, 1979). Poultry manure contain all essential plant nutrients that play significant role in improving quality as reported by Prabakaran and Pichal (2003).

Therefore it is concluded that amongst different organic nutrientcombination treatment $N_2$ (poultry manure + *Azotobacter*+ wood ash + phosphoroussolubilizing bacteria + oil cake) was more effective toimprove the fruityieldsand quality.

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## Tables

Table 1. Effect of integrated organic nutrient management on physical characters of fruit and yield of strawberry cv. Kurdistanin Iran.

| Treatments | Fruit length (cm) | Fruit diameter (cm) | Fruit volume ($cm^3$) | Fruit weight (g) | Yield (g/ plant) | Yield (kg/ha) |
|---|---|---|---|---|---|---|
| $N_1$ | 3.76 | 2.98 | 18.91 | 9.81 | 230.91 | 128.28 |
| $N_2$ | 3.95 | 3.11 | 20.39 | 11.11 | 238.95 | 132.75 |
| $N_3$ | 3.79 | 2.96 | 18.87 | 9.53 | 230.87 | 128.26 |
| $N_4$ | 3.91 | 3.08 | 20.34 | 10.01 | 238.35 | 132.42 |
| $N_5$ | 3.00 | 2.80 | 16.40 | 7.99 | 210.40 | 116.88 |
| LSD (0.05) | 0.034 | 0.040 | 0.044 | 0.25 | 0.044 | 0.153 |
| + S.E. of mean difference | 0.016 | 0.017 | 0.021 | 0.122 | 0.021 | 0.075 |

## Figures

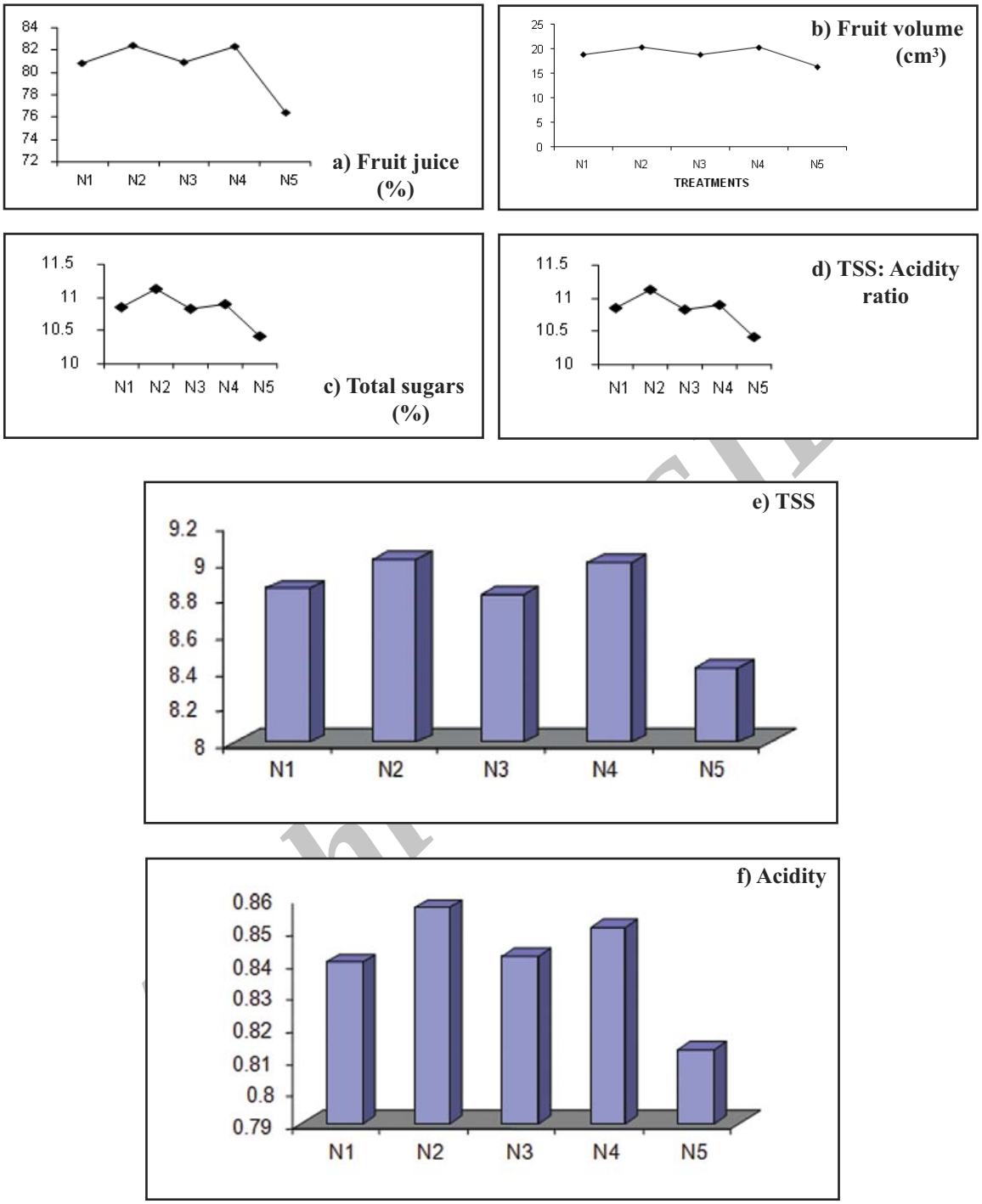


Fig. 1. Effect of integrated organic nutrient management on fruit juice (a), fruit volume (b), total sugars(c),TSS :Acidity ratio (d), TSS and acidity (f) of strawberry cv. Kurdistan.