Asian Journal of Plant Sciences

ISSN 1682-3974

science alert

ANSInet
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Asian Journal of Plant Sciences 2 (1): 113-115, 2003
ISSN 1682-3974

Seasonal Variation in Nutrient Concentration of Bearing and Non-bearing Terminals in Mango (*Mangifera indica* L.)

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Abstract: The present project was initiated to find out level of various nutrient elements in leaves at various growing stages. It was noticed that leaves of bearing terminals showed less concentrations of nutrients at stage one (0.956% N, 0.057% P, 0.918% Ca) which gradually increased from stage 2nd (0.981% N, 0.062% P, 1.131% Ca) to stage three (1.626% N, 0.182% P, 2.482% Ca) with minor variation in case of K, Mg and Fe. In case of non-bearing terminals, highest level of nutrients was found at stage one (1.589% N, 0.203% P, 0.839% Mg) with a gradual decrease up to stage three (0.902% N, 0.063% P, 0.197% Mg) with minor variation in K and Cu. In Fe, sugars and starch, a reverse pattern was observed. Zn and Mn showed no variation from first to third stage.

Key words: Mango, nutritional status, after harvest, fruit bud differentiation, bud burst stage, bearing and non-bearing terminals

Introduction

Pakistani mangoes are considered best and much liked in the international markets due to their excellent taste, flavour and high nutritional values. There is a great scope and bright future for earning of foreign exchange by exporting mangoes to their importers especially Middle East and Europe. Unluckily, the yield from our mango orchards is not appreciable and it is a matter of great concern that our yield is too low as compared to other mango growing countries. From export of mango, Pakistan earns about 6 million U.S dollars annually (Anonymous, 2000). There may be so many factors responsible for this low yield but non-judicianal use of fertilizer affects greatly to lessen the production. Present project was hence initiated to find the level of various nutrient elements in leaves at various stages/times so that we can judge the actual position and deficient elements can be applied to improve the production.

Flowering has been thought to be regulated by C/N ratio and seasonal changes in this ratio were generally important which determine fruit bud formation in mango (Naik and Shah, 1937; Kraus and Kraybill, 1981) and high C/N ratio have been reported in the bark of mango during initiation and differentiation period (Sen *et al*., 1965). Levels of sugars and starch were found changing in different stages in the shoots of different mango cultivars. Total carbohydrate contents peaked at the flower bud formation (Suryanarayana and Rao, 1976; Veera and Rao, 1977). NPK and Mg concentration increased as the leaf age decreased demonstrating the mobility of these elements. Leaf N, P, K, Mg and S concentrations were low during flowering and fruiting (Poncher *et al*., 1993). The nutrient status of mango plant was found greatly affected by time of the year and stage of growth. Soluble and protein N contents of leaf, bark and wood were significantly higher during initiation and differentiation period (Sen *et al*., 1963). NPK level reached the highest level at pea stage and declined thereafter reaching the lowest level at full grown fruit stage (Pathak and Pandey, 1977). Low level of N and P was found at flowering stage in blooming than non-blooming flushes.

Materials and Methods

Twelve years old mango cv. Langra were selected for these studies. Five terminals of each category from each tree were used for collection of leaf samples.

The leaf samples were collected at three stages (stage 1- after harvest (1st July), stage 2- at fruit bud differentiation (15th August) and stage 3- at bud burst stage (1st February).

Total nitrogen was determined by Gunning and Hibbard's method of sulphuric acid digestion, distillation was made on micro-Kjeldahl's apparatus (Jackson, 1962).

Wet digestion of the plant material was carried out according to the method described by Toth *el al*. (1948). Phosphorus was determined by Nitrovandomolybdate yellow colour method according to Cottenie *et al*. (1979). Potassium was determined by using Corning EEL Flame Photometer.

Ca, Mg, Zn, Fe, Cu and Mn were determined by PYE Unicam Atomic Absorption spectrophotometer (Model SP2900) using conditions given for obtaining maximum sensitivity for each element.

Carbohydrates were estimated as soluble (sugars) and

Table 1: Level of various nutrient elements in bearing terminals at three different stages

Stages	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	Cu (ppm)	Fe (ppm)	Zn (ppm)	Mn (ppm)	Sugar (mg g^{-1})	Starch (mg g^{-1})
1	0.956b	0.057b	0.432b	0.918b	0.240b	11.7b	49.4b	20.0b	56.0b	2.67c	8.57c
2	0.981b	0.062b	0.401b	1.131b	0.199b	11.9b	48.9b	22.6b	56.3b	3.99b	9.77b
3	1.626a	0.182a	0.991a	2.482a	0.668a	34.0a	107.1a	35.8a	99.4a	5.66a	11.99a

Table 2: Level of various nutrient elements in non-bearing terminals at three different stages

Stages	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	Cu (ppm)	Fe (ppm)	Zn (ppm)	Mn (ppm)	Sugar (mg g^{-1})	Starch (mg g^{-1})
1	1.589a	0.203a	0.889a	2.205a	0.839a	29.20a	15.20c	NS	NS	3.790c	7.920c
2	1.571a	0.191a	0.965a	2.490a	0.795a	31.00a	52.30b	NS	NS	5.880b	8.880b
3	0.902b	0.063b	0.317b	1.116b	0.197b	19.10b	79.70a	NS	NS	7.190a	9.960a

insoluble (starch), carbohydrates as described by Yoshida *et al.* (1976).

Statistical method: The experiment was arranged according to randomized complete block design and various means were compared using DMR test described by Steel and Torrie (1980).

Results

In case of bearing terminals 0.956% nitrogen was noted at stage one which increased through stage two, although both stages were at par statistically. Maximum nitrogen (1.628%) was observed at stage three. Similarly all the other nutrients and carbohydrates were found at low level at stage first and at highest level at third stage. They were found in an order of 0.057, 0.062, 0.062% P, 0.0432, 0.401, 0.99% K, 0.918, 1.131, 2.482% Ca, 0.240, 0.199, 0.668% Mg, 11.7, 11.9, 34.0 ppm Cu, 49.4, 48.9, 107.1 ppm Fe, 20.0, 22.6, 35.8 ppm Zn, 56.0, 56.3, 99.4 ppm Mn, 2.67, 3.99, 5.66 mg/g sugar and 8.57, 9.77, 11.99 mg/g starch for stages one, two and three, respectively (Table 1).

When these three stages were compared for non-bearing terminals, a reverse pattern was observed as against bearing terminals for various nutrient elements except Zn and Mn in which results were found non significant. Stage first exhibited higher level of nutrients, which decreased to the lowest level at third stage. Fe, sugar and starch opposed these results with 15.20, 52.30, 79.70 ppm Fe, 3.790, 5.880, 7.190 mg/g sugar and 7.920, 8.880, 9.960 mg/g starch for stage one , two and three, respectively. Cu showed variable results as 29.20, 31.00 and 19.10 ppm for these three stages, respectively. Other nutrients were found in an order of 1.589, 1.571, 0.902, % N, 0.203, 0.191, 0.063% P, 0.889, 0.965, 0.317% K, 2.205, 2.490, 1.11% Ca and 0.839, 0.795, 0.197% Mg for first, second and third stage respectively (Table 2).

Discussion

Bearing flushes showed low level of nutrients at harvest time, which increased slowly through fruit bud differentiation being high at bud burst stage. It indicates that maximum amount of nutrients were consumed in fruit setting and development, thus their levels was found low initially but after harvest, there did not remain any sinks, hence level of nutrients was found increasing. On the other hand, non-bearing flushes exhibited elevated levels of nutrients at harvest stage, which decreased gradually upto bud burst stage. Such fluctuation in the nutrient concentrations proved that as there was no sink point on these flushes at first stage hence they exhibited higher level of nutrients but after that as a result of fruit bud differentiation, initiation process started in these terminals which used stored nutrients upto bud burst stage; as a result of such consumption, level of nutrients declined to the lowest upto stage third. Results of this experiment are in line with the finding of Suryanarayana and Rao (1976); Veera and Rao, (1977); Pathak and Pandey (1977) and Sergent *et al.* (1993).

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