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Effect of Fruit Bagging, Reflective Mulch and Foliar Potassium Spray on Quality of Apple

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ABSTRACT

An effect of fruit bagging, reflective mulch and foliar potassium spray on quality of apple cv. Fuji Zehn Aztec was studied in high density Apple block of Division of Fruit Science, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar during 2016-2017. Treatments consisted of fruit bagging done at two time periods (4 and 6 weeks after petal fall), reflective mulch at two different widths (100cm and 75 cm), potassium sulphte spray at two concentrations (0.50% and 0.75%) and the all 4 combinations of reflective mulch and potassium sulphate spray, constituting total 11 treatments. The results revealed that fruit size and yield did not show any significant effect by any treatment, however the improvements with respect to total sugars, ascorbic acid, TSS, TSS: acid ratio and organoleptic rating were observed by all the treatments over control. Fruit firmness and acidity were decreased by all the treatments as compared to control. On overall basis the treatment consisting of potassium sulphate spray@0.75% + polyethylene reflective mulch (100cm) proved to be most appreciating wherein figures regarding fruit weight (178.20g), total sugars (15.04 %), ascorbic acid (5.97 mg/100g), TSS (18.80 %), TSS: acid ratio (89.52) and organoleptic rating (3.80/5) were above the values as recorded under other treatments. The study indicated that Fuji apple showed positive responses to application of fruit bagging, reflective mulch and foliar potassium spray in enhancing the fruit biochemical characters.

Key Words: Apple, Fruit bagging, Foliar potassium spray, Petal fall, Reflective mulch.

INTRODUCTION

The cultivated apple (Malus × domestica Borkh) is the premier table fruit of the world known as King of temperate fruits. Fuji apples are a cross between two classic American apple varieties-Red Delicious and Virginia Ralls Janet. Poor red colouration is often a serious problem in the culture of Fuji apples. The high popularity of Fuji is due to its good taste and excellent keeping quality. Red coloured apples are preferred in the market as they attract the consumers. The various methods or strategies which can be used to increase red skin colouration in apple along with other quality parameters are the use of reflective mulch (Miller and Greene 2003), fruit bagging (Arakawa 1988), (Arakawa 1991), foliar spray of potassium (Saure 1990; Witney 1997) and various management practices (proper pruning, irrigation fertilization) etc.

The cultivar Fuji Zehn Aztech has been developed in New Zealand by mutation from standard Fuji and has gained considerable popularity worldwide. Fuji Zehn Aztec is a full coloured, blush-type that harvests late season with standard Fuji. The tree is healthy and vigorous and the fruit exhibits the traditional, sweet flavor of Fuji. In the present study effect of fruit bagging, reflective mulch and foliar potassium spray on quality of apple cv. Fuji Zehn Aztec was ascertained during under temperate conditions of Kashmir.

MATERIALS AND METHODS

The effect of fruit bagging, reflective mulch and foliar potassium spray on quality of apple cv. Fuji Zehn Aztec was undertaken at the experimental fields of Division of Fruit Science in high density block, SKUAST-K, Shalimar. The experimental

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site is situated at an elevation of 1685 meters above mean sea level. The design of experiment used was Randomized Complete Block Design with 03 replications. The total number of treatments given were 11 as follows; T1Control, T2 Fruit bagging (4 weeks after petal fall), T3 Fruit bagging (6 weeks after petal fall), T4 Polyethylene Reflective mulch (100 cm width), T5 Polyethylene Reflective mulch (75 cm width), T6 Potassium sulphate spray @ 0.50%, T7 Potassium sulphate spray @ 0.75%, T8 Potassium sulphate spray@ 0.50% + Polyethylene Reflective much (100 cm), T9 Potassium sulphate spray @ 0.5% + Polyethylene Reflective mulch (75 cm), T10 Potassium sulphate spray @ 0.75% + Polyethylene Reflective mulch (100 cm), T11 Potassium sulphate spray @ 0.75% + Polyethylene Reflective mulch (75 cm). Moreover, the double layer paper bags consisting of an inner red coloured liner and an outer white bag were placed on fruitlets, 4 and 6 weeks after petal fall. The bags which were placed 4 weeks after petal fall were removed 6 weeks before predicted harvest date and similarly the bags which were placed 6 weeks after petal fall were removed 4 weeks before predicted harvest date. Also, Polyethylene reflective mulch having a width of 100cm and 75cm was placed beneath the tree canopies 40 days before expected date of harvest. Foliar application in the form of potassium sulphate (0.5% and 0.75%) was applied 100 days after petal fall.

The physical characteristics recorded were; fruit length, fruit diameter, fruit volume, fruit weight, fruit firmness, yield and organoleptic rating and the chemical characteristics of the fruit observed were; ascorbic acid, total soluble solids, total sugars, fruit acidity and total soluble solids/acidity ratio

RESULTS AND DISCUSSION

Fruit size (length, diameter and volume)

The data pertaining to fruit size depicts that the application of fruit bagging, reflective mulch and potassium spray alone or in combination had no significant effect on fruit size (Table 1). However, a close examination of data showed that fruit size in terms of fruit length, fruit diameter and fruit volume was increased by the treatment T_{10} (0.75% potassium sulphate spray + 100 cm wide Polyethylene reflective mulch. These results are in agreement with the findings of Prive *et al* (2011)

Table 1: Effect of fruit bagging, reflective mulch and foliar potassium spray on fruit length, fruit diameter and fruit volume of apple cv. Fuji Zehn Aztec

Treatment	Fruit length (cm)	Fruit diameter (cm)	Fruit volume (cm^3)	Fruit weight (g)	Fruit yield (kg/tree)	Fruit firmness (kg/cm^2)
T_1	6.00	7.01	175.39	157.39	9.02	11.78
T_2	6.12	7.17	177.17	158.50	9.39	11.50
T_3	6.05	7.03	176.62	158.01	9.29	11.58
T4	6.20	7.34	180.40	164.06	9.58	11.28
T_5	6.15	7.29	179.05	162.08	9.42	11.36
T_6	6.22	7.50	181.07	166.14	10.00	11.22
T_7	6.38	7.54	189.65	173.13	10.55	10.92
T_8	6.28	7.51	186.84	170.17	10.25	10.25
T_9	6.24	7.51	184.11	169.18	10.15	10.55
T_{10}	6.55	7.69	195.14	178.20	11.53	10.00
T_{11}	6.40	7.54	191.44	176.34	10.98	10.14
C. D ($p< 0.05$)	N. S	N. S	N. S	1.13	N. S	0.71

who reported that reflective mulches do not affect fruit size in apples. Tran *et al* (2015) also reported that bagging fruits of pear (*Pyrus communis*) with different materials including paper bags does not affect fruit size.

Fruit weight (g)

Data reveals that the highest fruit weight (178.20g) was observed with treatment T_{10} (0.75% potassium sulphate spray + 100cm wide Polyethylene reflective mulch). The increase in fruit weight may be attributed to higher photosynthetic activities. Photosynthates are supplied to fruits by leaves and fruit act as metabolic sink, which were higher on account of potassium fertilization.

Fruit yield (kg/tree)

The data pertaining to fruit yield reveals that after the application of fruit bagging, reflective mulch and potassium spray alone or in combination had no significant influence on fruit yield. However maximum fruit yield (11.53 kg/tree) was observed in treatment T_{10} (0.75% potassium sulphate spray + 100 cm wide Polyethylene reflective mulch). There are also studies showing that bagging had no effect on fruit size (Jia *et al,* 2005) and yield. Similarly Funke and Blanke (2005) reported that fruit size of Braeburn apple fruit at harvest was unaffected by reflective ground cover (Table 1).

Fruit firmness (kg/cm^2)

It is evident from the data that application of fruit bagging, reflective mulch and potassium spray alone or in combination had a significant influence on fruit firmness (Table 1). The highest fruit firmness (11.78 kg/cm^2) was observed in T_1 (control) whereas the lowest fruit firmness (10.00 kg/cm^2) was observed in T_{10} (0.75% potassium sulphate spray + 100cm wide Polyethylene reflective mulch). The decrease in firmness may be due to the fact that Ca content of fruits sharply decreased due to increased K application, thus low concentration of Ca^{2+} will definitely tell upon cell wall formation, hence on fruit firmness.

Organoleptic rating (pts)

It was evident from that application fruit bagging, reflective mulch and potassium spray alone or in combination had significant influence on organoleptic rating of fruit (Table 3). The highest organoleptic rating (3.80) was observed in T10 (0.75% potassium sulphate spray + 100 cm wide Polyethylene reflective mulch) followed by 3.62 in T11 (0.75% potassium sulphate spray + 75 cm wide polyethylene reflective mulch). This may be probably due to increase in soluble solids and sugars by these treatments which result in high organoleptic rating of the fruit.

Chemical characteristics

Ascorbic acid (mg/100g)

Studies revealed that maximum ascorbic acid content (5.97 mg/100g) was observed in treatment T10 (0.75% potassium sulphate spray + 100 cm wide Polyethylene reflective mulch) followed by treatment T11 (0.75% potassium sulphate spray + 75 cm wide Polyethylene reflective mulch) and the lowest ascorbic acid content (3.60 mg/100g) was recorded in treatment T1 (Control). Although light is not essential for the biosynthesis of ascorbic acid in plants, good exposure or high light intensity is, generally, a positive factor for the accumulation of ascorbic acid as observed in many plants (Lee and Kader 2000) and fruits (Poiroux-Gonord *et al* 2010). This could be due to the fact that ascorbic acid is synthesized from sugars supplied by photosynthesis in plants

Total sugars (%)

Highest value of total sugar (15.04%) was recorded with treatment T10 (0.75% potassium sulphate spray + 100cm wide Polyethylene reflective mulch) and the lowest total sugar content (12.40 %) was recorded in treatment T1 (Control). The possible reason for this increment is due to increase in light intensity which enhanced photosynthesis

Total soluble solids (%)

The investigation revealed that highest total soluble solids (18.80%) were recorded with

Table 2. Effect of fruit bagging, reflective mulch and foliar potassium spray on anthocyanin content, ascorbic acid, total sugars, and organoleptic rating content of apple cv. Fuji Zehn Aztec.

Treatment	Ascorbic acid (mg/100g)	Total sugars (%)	Organoleptic rating (pts 1-5)	TSS (%)	Acidity (%)	TSS: Acid ratio
T_1	3.60	12.40	2.85	15.50	0.30	51.66
T_2	4.05	12.93	2.95	16.17	0.28	57.71
T_3	3.89	12.43	2.93	15.53	0.29	53.55
T4	4.35	13.60	2.99	17.00	0.27	62.96
T_5	4.24	13.19	2.97	16.47	0.27	60.96
T_6	4.48	13.85	3.01	17.33	0.26	66.65
T_7	4.91	14.07	3.12	17.63	0.25	70.53
T_8	5.20	14.09	3.31	17.61	0.24	73.33
T_9	5.01	14.08	3.21	17.60	0.24	73.33
T_{10}	5.97	15.04	3.80	18.80	0.21	89.52
T_{11}	5.52	14.61	3.62	18.23	0.22	82.86
C.D ($p< 0.05$)	0.43	0.50	0.32	0.67	0.04	2.76

treatment T10 (0.75% potassium sulphate spray + 100cm wide Polyethylene reflective mulch) (Table 2) whereas the lowest total soluble solids (15.50%) were recorded in treatment T1 (Control). The increase in total soluble solid content of fruits may be attributed to higher photosynthetic rates in response to higher light intensity (Taiz and Zeiger 2006.

Acidity (%)

The data (Table 2) showed that the acidity decreased with the applicaton of potassium sulphate spray and reflective mulch . Significantly lowest acidity (0.21%) was found in treatment T10,whereas the highest acidity (0.30%) was recorded under treatment T1 (control). This may be due to conversion of organic acids into sugars and effect of potassium on enzymatic activity of cells and precipitation of tartaric acid as potassium bitartarate which is insoluble, thus decreasing acid levels in fruits.

TSS/acid ratio

It was evident that maximum sweetness index of 89.52 was recorded in treatment T10 and the minimum sweetness index 51.66 was found in treatment T1 (control). The increased TSS/acid acid ratio is because the treatment T10 recorded the maximum total soluble solids and lowest acidity.

REFERENCES

Arakawa O (1988). Characteristics of colour development in some apple cultivars: Changes in anthocyanin synthesis during maturation as affected by bagging and light quality. *J Japanese Soc for Hortl Sci* **57**: 373-380.

Arakawa O (1991). Effect of temperature on anthocyanin accumulation in apple fruit as affected by cultivar, stage of fruit ripening and bagging. *J Hort Sci* **66**(6): 763-768.

Funke K and Blanke M (2005). Can reflective ground cover enhance fruit quality and colouration. *J Food Agri and Environ* **3**(1): 203-206.

Jia H J, Araki A, Okamoto G (2005). Influence of fruit bagging on aroma volatiles and skin colouration of 'Hakuho' peach (*Prunus persica* Batsch). *Postharvest Biol and Technol* **35**: 61-68.

Lee S K and Kader A A (2000). Preharvest and postharvest factors influencing vitamin C content of horticultural crops. *Postharvest Biol and Technol* **20**: 207-220.

Miller S S and Greene G M (2003). The use of reflective film and ethephon to improve red skin colour of apples in Mid-Atlantic region of United States. *Hort Technol* **13**(1): 90-99.

Poiroux-Gonord F, Bidel L P R, Fanciullino A, Gautier H, Lauri-Lopez F and Urban L (2010). Health benefits of vitamins and secondary metabolites of fruits and vegetables and prospects to increase their concentrations by agronomic approaches. *The J Agri and Food Chem* **58**: 12065-12082.

Prive J P, Russel L and LeBlanc A (2011). Impact of reflective ground cover on growth, flowering, yield and fruit quality in Gala apples in New Brunswick. *Canadian J Pl Sci* **91**: 765-772.

Saure M C (1990). External control of anthocyanin formation in apple. *Scientia Horticulturae* **42**: 181-218.

Taiz L and Zeiger E (2006). *Plant Physiology*. Sinauer Associates: Sunderland, MA pp. 197-344.

Tran D, Yen C and Chen Y H (2015). Effects of bagging on fruit characteristics and physical fruit protection in red pitaya (*Hylocereus* spp.). *Biological Agriculture and Horticulture* **31**(3): 158-166.

Witney G (1997). Nutrient sprays and fruit quality. *Western Fruit Grower* **32**: 14-29.

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