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SHORT COMMUNICATION

TRIACONTANOL INDUCED CHANGES IN KERNEL DRY MATTER, CARBOHYDRATE CONTENT AND YIELD OF WATER CHESTNUT (*TRAPA BISPINOSA* L.) FRUIT

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Two local cultivars of water chestnut (*Trapa bispinosa*) red fruit bearing Haldipada red and green fruit bearing Haldipada green were grown for 125 days to observe the effect of triacontanol on fruit quality and yield of nuts. Foliar application of plant growth regulator triacontanol 0.05% at 1:100 dilutions was done at 75,90 and 120 days after planting over floating canopy of two cultivars of water chestnut. The control treatment was sprayed with distilled water instead of triacontanol. The triacontanol treatment increased the volume of individual fruit by 45.32 % in Haldipada green and 47.11 % in Haldipada red cultivars. The fresh fruit yield also increased 32% in green and 31.25 % in red cultivars. But the soluble carbohydrate content in fresh fruits decreased by 25.46 % to 29.61 % in triacontanol treated green and red fruit cultivars, respectively compared to that in control. But on dry weight basis there was no significant decrease in soluble carbohydrate content in treated fruits. This is mainly due to decrease in dry matter content by 22.40 to 25.60 % per unit fresh weight in treated fruits compared to control. Thus to increase fruit size Triacontanol application might be beneficial, but to extract flour it may not be suitable due to less dry matter content in the fruit.

Key words: **Carbohydrate, triacontanol, water chestnut, yield**

Water chestnut is an important vegetable crop in waterlogged areas in Eastern India (Ahmed and Singh 1999, Hazra *et al.* 1996). The crop is popularly grown mainly in railway side depressions or highway side depressions. Fruits are consumed either fresh or after drying as flour and are rich in nutritional composition (Gopalan *et al.* 1987). The properties of water chestnut starch are also close to potato starch and have potential for use in textile sizing and ice cream preparation (Srivastava and Vatsya 1986). As an aquatic crop, water chestnut has an inherent capability to grow under waterlogged situation. The extension ability of stem provides the crop an ability to survive under short term submergence (Roy Chowdhury *et al.* 2003). Hence the crop can be grown in flood prone low land in shallow waterlogged condition or under short-term submergence. Eventhough the crop is grown with traditional practices, the fertilizer requirements for growing water chestnut under different types of waterlogged condition is available in literature for either water chestnut alone (Roy Chowdhury *et al.* 2004a, Poddar 2003) or integrated cultivation of fish and water chestnut together (Roy Chowdhury *et al.* 2005). However, very little is known about the effect of plant growth substances (PGS) on water chestnut. Triacontanol, a long-chain alcohol has been known as potent growth promoter in many plant species (Ries 1990, Kumaravelu *et al.* 2000). Information on the effect of triacontanol on yield and other quality parameters of water chestnut fruits is quite meagre. Therefore, attempt was made to assess the

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effect of triacontanol on the yield and quality of water chestnut fruits.

The experiment was conducted at Research Farm of Water Technology Centre for Eastern Region, Mendhasal during June-December. Two local water chestnut varieties were grown in randomized block design with four replications. The water chestnut seedlings of two popular fruit type, i.e. green fruit (peel color) bearing type cultivar (Haldipada green) and red fruit (peel color) bearing cultivar (Haldipada red) was planted at a spacing of 1.5 m x 1.5 m during June under marshy condition. The plot size was 2 m x 3 m and was demarcated by 45 cm wide nylon net on the surface of the water body. The compost was applied @ 8 t/ha before planting. The N:P:K fertilizer @ 40:60:40 were applied in three splits. The one third of N as urea and K as muriate of potash with full P as single super phosphate was applied as basal. The rest 2/3rd N and K was applied in two splits at two and four months after planting (Roy Chowdhury *et al.* 2003). Hand weeding was done each time before application of fertilizers. Foliar application of aqueous solution of 0.05% (v/v) triacontanol at 1:100 dilutions was done at 75, 90 and 120 days after planting (DAP). The control plants were sprayed with distilled water. The dissolved oxygen content of water body at 30 and 50 cm depth and temperature at 30 cm depth of water was recorded with a YSI 550 hand held dissolved oxygen and temperature system (YSI Inc., Yellow Spring, Ohio, USA) till the crop completely decomposed from the surface of the water. The depth of the water body was also recorded at periodic interval. Fruits from the treated plants were collected at 125 days and were analyzed for fruit volume, soluble and insoluble carbohydrate content and dry matter content of the fruit. The fruit volume was measured by displacement of water in a measuring cylinder. Five fruits were collected from three randomly selected plants and were used for measuring the volume of the fruits (Roy Chowdhury *et al.* 2004b). The percentage dry-matter content of the kernel of the fruit was determined by separating the peel carefully without damaging the fruit. The fresh fruits were weighed then oven-dried at 70°C to determine the dry weight. The soluble as well as insoluble carbohydrate contents of fruit collected from triacontanol treated and untreated fruits were measured with anthrone reagent (Yoshida *et al.* 1976, CTCRI 1983). The standard error of mean of observations was calculated following Gomez and Gomez (1984).

The dissolved oxygen content of the water body both at 30cm as well as at 60 cm depth, steadily declined from second months after planting and continued till fifth month after planting till canopy of the crop decomposed exposing the surface water (Fig.1). The dissolved oxygen content of water in a water body in low lying area is important in determining type of fishes which can grow

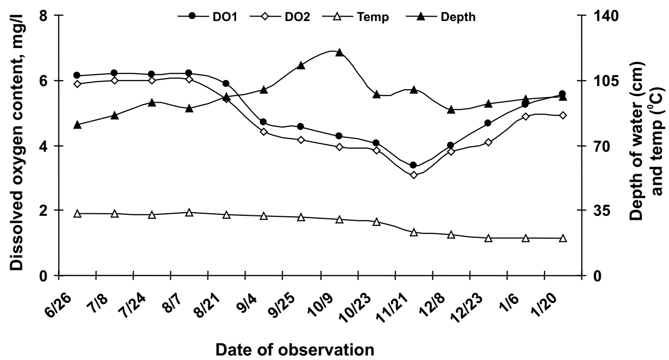

Fig. 1. The periodic changes in depth of water (cm), dissolved oxygen content (mg/l) at 30 cm (DO1) and 60 cm (DO2) depth and temperature of the water at 30cm depth in the water body growing water chestnut during experimental period and beyond till the crop decomposed and disappeared from the surface of water.

in the water body along with water chestnut (Ahmed and Singh 1999). In our study also the of dissolved oxygen content showed usual depleting trend .The decrease in dissolved oxygen concentration in the water beneath water chestnut canopy has also been reported earlier (Ahmed and Singh 1999, Roy Chowdhury *et al.* 2003).The decline in dissolved oxygen content of the water was mainly due to smothering effect of thick water chestnut canopy on the surface of the water (Ahmed and Singh 1999). The temperature of the water body growing water chestnut did not show much change till onset of winter at fifth month stage. The depth of water showed an increase during third to fourth month stage coinciding with monsoon and the increase was due to rainfall during that period (Fig.1). The average volume of individual fruit at 125 days after planting in treated plant increased in both red and green type of fruits (Fig.2). However the extent of increase was found different in the two cultivars. In response to foliar spray with triacontanol, the green peel cultivar, Haldipada green showed 45.32 % increase in fruit volume whereas in red

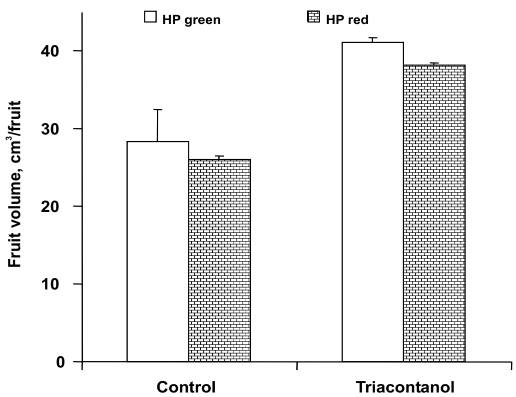

Fig. 2. The changes in fruit volume at 125 days after planting in control and triacontanol treated fruits of Haldipada green and Haldipada red cultivars. Each value is mean of four replications. Vertical bars are ±SE. Control distilled water spray, Triacontanol spray 0.05% at 1:100 dilution.

peel cultivar the extent of increase was 47.11 % (Fig 2). The nut yield in triacontanol treated plants increased in both Haldipada red (31.25%) as well as in Haldipada green (32%) (Fig. 3). In lettuce application of triacontanol has been reported to increase yield (Knight

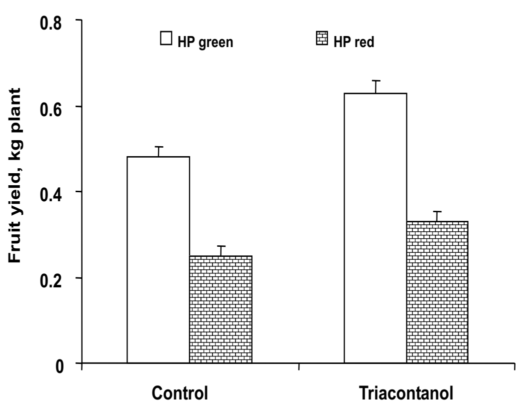

Fig. 3. The fruit yield of control and triacontanol treated plants of Haldipada green and Haldipada red cultivar at 125 days after planting. Values are mean of four replications ±SE. Control with distilled water spray. Triacontanol spray 0.05% at 1:100 dilution.

and Mitchell 1987). In rice application of triacontanol had up-regulated the photosynthesis process presumably through complex mechanisms (Chen *et al.* 2002) and maintained photosynthesis in pine seedlings avoiding drought induced membrane injury (Rajshekharan and Blake 1999). Our observation earlier, also showed that foliar application of triacontanol with similar concentration and mode of application increased fruit yield in Haldipada green by 40%. The water chestnut fruit kernel mainly contains carbohydrates in the form of water soluble carbohydrate as well as in insoluble form as starch (Roy Chowdhury *et al* 2004). Eventhough insoluble carbohydrate content did not differ significantly, the soluble carbohydrate contents on fresh weight basis showed a decrease in treated fruits in both red and green (peel color) water chestnut fruits (Fig 4). The extent of decrease was more in red type cultivars (29.61%) as

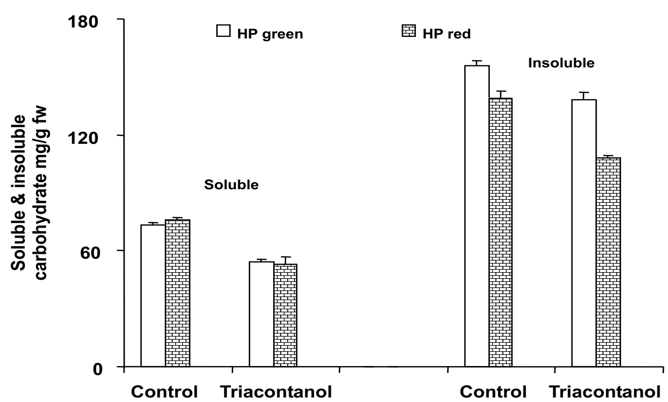

Fig. 4. The changes in soluble and insoluble carbohydrate content in fresh kernels of Haldipada green and Haldipada red cultivars. Each value is mean of four replications. Vertical bars are ± SE. Control with distilled water spray, Triacontanol spray 0.05% at 1:100 dilution.

compared to green type (25.46%) over control. But on dry weight basis there was no significant difference in carbohydrate content (Fig 5). The kernel-dry matter per unit fresh weight decreased in treated fruits (Fig 6). The dry matter content in Haldipada green decreased 25.6 % compared to water sprayed fruits, whereas in red peel cultivar Haldipada red the kernel dry matter decreased by 22.4 %. This decrease in dry matter content might be due to increase in water content in fresh kernel. The growth regulator triacontanol has been reported to

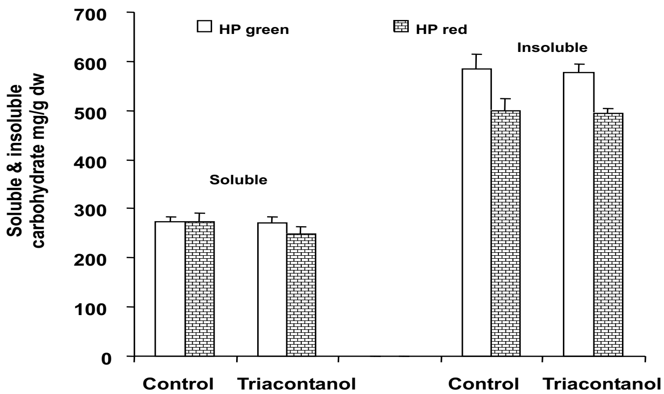

Fig. 5. The changes in soluble and insoluble carbohydrate content in dry kernels of Haldipada green and Haldipada red cultivar. Each value is mean of four replications. Vertical bars are ± SE. Control with distilled water spray. Triacontanol spray 0.05% at 1:100 dilution.

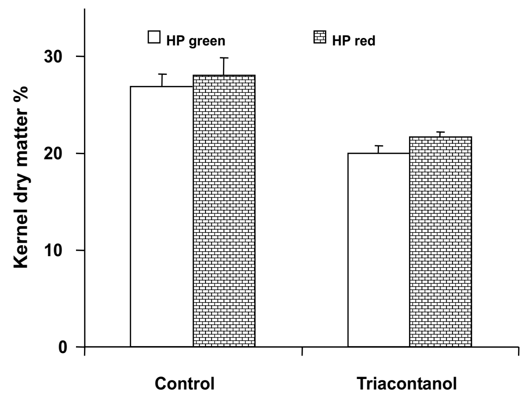

Fig. 6. The changes in kernel dry matter of Haldipada green and Haldipada red cultivar. Each value is mean of four replications. Vertical bars are ± SE. Control with distilled water spray. Triacontanol spray 0.05% at 1:100 dilution.

stimulate water uptake and growth in rice seedlings (Ries and Wert 1987). The increased water content in triacontanol treated fruit kernel in water chestnut fruit led to decrease in carbohydrate content and dry matter on fresh weight basis. However it has been observed that starch and dry matter content of the kernel is closely correlated in developing water chestnut fruits. The trend was better in mature fruits of water chestnut (Roy Chowdhury *et al*. 2004b). Thus from our observations it was apparent that foliar application of triacontanol enhanced the fruit size of water chestnut and the treated fruits showed reduced carbohydrate and dry matter content. Hence for use as fresh fruit triacontanol application appeared beneficial due to better fruit size and higher yield but for making flour these fruits might not be suitable due to low carbohydrate and dry matter content.

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