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STUDY ABOUT YIELD AND CUTTING'S LOSSES OF TWO TEA CLONE BUSHES IN IRAN

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In the first trial, study conducted to compare of yield between two shapes of pruning (curved and flat) of tea bushes (clone 100). After leaf harvesting, curved pruning bushes had more yield than flat pruning bushes. Thus curved pruning method can be advised to gardeners as a reliable and superior pruning method. In the secondary experiment, study was carried out to investigation of cutting's losses in all head-cuttings and comparison between tow types bush in tea (100 and selective). Results showed that there is significant difference between 100 and selective clones at $p \leq 0.05$. It means that obtained mean cutting's losses by selective was less than 100 bushes.

Key words: bush, curved and flat pruning, tea, vegetative propagation

INTRODUCTION

Tea is one of the most important strategic crops in Iran. About 32000 ha of farmland in Iran are under tea cultivation (HOJJAT-ANSARI *et al*., 2011). Tea (*Camelia sinensis* L.) is a perennial plant belonging to the Theacea family (RAVICHANDRAN, 2002; ZAMAN *et al*., 2011). Management practices of tea like pruning, tipping and plucking are interrelated and leniency of one compensates for severity of others. Pruning is one of the most important methods of gardening used to maintenance of permanently vegetative bushes, motivation of buds to growth, crop production, development of productive shoots, reactivation of vegetative growth, maintenance of healthy shoots, and remove of unhealthy-rotted shoots. Pruning should be done

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by skilled workers and standard pruning instruments. Precise pruning can be used to increase the yield in each bush. A number of experiments on machine pruning were done during last years and the prompt influences of mechanical pruning on yield, quality, productivity, and machine pruning costs were reported (SAIKIA *et al*., 2011). Prune is necessary to help improve frame of bush and rejuvenation during hot and dry period. Pruning improves agronomic characteristics of tea plants (BARUA, 1989). Pruning is one of the most important operations directly attributes to yields and qualitative traits of tea (TOCKLAI, 2008). Flat shape pruning is usually used in the world but in some regions a curved upper area is designed having semi-cylindrical surface (WILSON, 1992). The goal of the first trial was to compare of yield in tow pruning shapes in Iran.

Tea Propagation by asexual method i.e. cutting is the most usual method of propagation to maintain the proper traits of mother plant. Cutting is one of the extensively practiced means of vegetative propagation in plants. It has many advantages such as being economical, not requiring much space and is rapid and simple. Cutting can be prepared from the stem, modified stem, roots or leaves. Among these, stem cutting has been used to propagate a variety of plants. In vegetative propagation by stem, cutting can be taken from the shoots of the plants with terminal or lateral buds, which are capable of developing adventitious roots and then to a complete plant (HARTMANN *et al*., 1997). HANSEN (1986, 1988) reported that cutting rooting can be affected by many factors such as position of cutting. Also season of cutting preparation may be related to rooting of cutting (LEAKY, 1983, 1990; KLEIN *et al*., 2000). It has been shown that apical cuttings rooted earlier than basal cuttings. In addition, basal cuttings had thicker stem diameter in comparison with apical cuttings (SOUNDY *et al*., 2008). In study by SAIFUDDIN *et al.* (2013) was cleared that cutting position affected on leaf area index, stem number and root initiation. It has been reported that growth rate and establishment of cutting may be dependent to position and diameter of stem (OPUNI-FRIMPONG *et al*., 2008; KRAIEM *et al*., 2010). In addition, another study showed that basal cutting had the highest rooting percentage (SHUKOR and LIEW, 1994).

The aim of the secondary trial was to introduce a propagation method decreasing the losses in nurseries, duration of propagation and expenses.

MATERIALS AND METHODS

A. Comparison of yield in two pruning shapes

This study was conducted in RCBD design with three replications at Tea Research Centre of Iran, Feshalam, Iran, situated 12 km near to Rasht in Guilan province of Iran during 2011-2012. Two tea clones, 100 (an improved tea clone) and natural Chinese hybrid were studied. The tea bushes were irrigated during the study. Also pesticides and herbicides were used to against pests and weeds in selected rows of bushes, respectively. Soil of field was fertilized by urea (800 kg/ha), ammonium phosphate (75 kg/ha) and potassium-magnesium sulfate (200 kg/ha) at three times in growth season. The latitude was north 37^0 $15^/$ height above the sea level (altitude 10 m). The lowest means for monthly temperatures (about 10.6^0C) during the experimentation period were from November to December, while the warmest (about 21^0C) months were from June to July. The annual average rainfall was 850 mm/yr, mainly occurred in spring and autumn (not evenly over the year). RH was about 70-80 %. Harvesting machine (curved and flat-blade) was used to harvesting the leaves. It is important that the upper surface of bushes be flatted and the workers needed to be skilled during machinery harvesting. Tow section of field include curved and flat were devoted to leaf harvesting. In each section, duration of leaf harvesting and yield of two-bush row were compared to each other. Lengths of curved and flat

sections were 54 and 48.30 m, respectively. In order to realize the true relationship and precise comparison of yield between two pruning method, three replications were devoted for each leaf harvesting surface. Also each replication included 9 harvests at 9 times from May to October.

B. Investigation of cutting's losses in two types of tea bush

This study was carried out to supply a new method in tea propagation to decrease cutting losses in nursery and inhibition of extra cost expenses and investment. For preparation the proper shoots and strong stems from mother plants, 20 appropriate bushes of 100 mother garden and 12 bushes of selective mother garden were selected. Treatments included cutting position (central and around shoot), bush type (100 and selective), and time of cutting. In fact total treatments were included cuttings from central shoots of bush 100 (C-100), cuttings from around shoots of bush 100 (A-100), cuttings from central shoots of selective bush (S-C), and cuttings from around shoots of selective bush (S-A). 100 cuttings in each treatment (three replicates in treatment, totally 1200 cuttings) were prepared. All data were subjected to analysis of variance (ANOVA) procedures and means were separated, using Duncan Multiple range test at $p \leq 0.05$.

RESULTS AND DISCUSSION

Comparison of yield in two pruning shapes

With regard to two-row selected bushes, harvesting time of leaf in curved section was shorter than in flat section. Also leaf yield in tow-row curved and flat sections were 22 kg and 14 kg, respectively (table 1).

Table 1. Comparison between two pruning methods on yield and Duration of harvest

Methods	Yield (kg/500 m^2)	Duration of harvest (kg/m)
Flat	433.2±64.2b	0.25±0.04b
curved	552.6±48.9a	0.45±0.08a

[a, b] letters indicate the statistical difference in columns.

It can be observed that there was significant difference in yield between flat and curved pruning. This might be the effect of more harvesting area in curved pruning shape resulted from heavier pruning by machine, implying previous study by SAIKIA *et al.* (2011). In addition, it can be said that time can be saved in curved pruning shape and gardener could harvest more leaf in same time in comparison with flat pruning. Better development of the frame after machine pruning has been reported by some experiments such as BARBORA and SARMA (1999).

Also number of primaries stubs were high in this study (data not shown) that is in agreement by results by SAIKIA *et al.*, (2011). There was significant difference in yield about pruning times confirming previous experiment. Totally pruning in spring significantly ($p<0.01$) reduced the yield as compared to summer pruning (Table 2), may be due to good irrigation in summer resulting more branching. This was related to the fact that the spring pruning diminished yield during the most productive time. In contrast, the pruning frequencies did not significantly affect on yield. Decentering plays an important role in the formation of a good bush frame

resulting higher yields in curved shape pruning and harvesting. DUTTA (2011) showed that there is positive relationship between yields and pruning namely yield increases if appropriate pruning is done that is in agreement with this study. Thus curved pruning shape is more productive than flat shape and that can be advised for tea cultivation regions.

Table 2. Effect of harvesting season on yield of tow pruning shapes

season	Flat Yield (kg/500 m^2)	Curved Yield (kg/500 m^2)
Autumn	110.6±39.2a	106.6±6.1a
Summer	203.4±3.8b	285.1±18.2a
Spring	119.7±20.2b	160±15.3a

[a, b] letters indicate the statistical difference in rows.

Investigation of cutting's losses in two types of tea bush

Table 3. Analysis variance of data in cutting's loss experiment

Source of variation	Degree of freedom	SS	MS	F
Cutting Time	2	5.50	2.75	1.98 NS
Cutting position	1	1.09	1.09	0.78 NS
Bush type	1	8.92	8.92	6.42 *
Cutting site x Bush type	1	0.03	0.03	0.02 NS
Error	6	8.33	1.390	…
Loss recording time	2	12.77	6.389	54.30 **
Time x Cutting site	2	0.26	0.131	1.11 NS
Time x Bush type	2	0.40	0.200	1.69 NS
Time x Site x Type	2	0.04	0.02	0.16 NS
Error	16	1.88	0.118	…

*, ** Significant at 5% and 1% level of probability, respectively. NS means non significant.

Analysis variance showed that there are significant differences between selective bushes about loss number at $P < 0.05$. Also difference among various times of loss number was significant at $P < 0.01$ probably resulted from effect of time on loss number (Table 3) confirming previous study by SOUNDY *et al* (2008). Also the result of this study is in agreement with results

of another study (SAIFUDDIN *et al*., 2013). According to the present observations, although difference between loss number of prepared cuttings of center and around in bush wasn't significant but loss number of center cuttings was lower (2.66) than around cuttings (4.18). Regarding to tow levels of bush type, it is clear that without mean comparison prepared cuttings of selective bushes has lower loss (1.83) than clone bushes (5.01). In addition, mean comparison in three loss recording time (Duncan, $P < 0.01$) showed that each recording time is classified in separated class and have significant difference, resulting to lowest and the highest loss in the first and third time, respectively. HAUT and KAZEMIAN (2010) reported that rooting percentage of many species such as tea was affected directly from stage of growth and stem position. In addition, it was discussed (BALESTRI and LARDICCI, 2006) that rooting and survival (loss number) were related to season of year, confirming the results of this investigation. It means that summer cutting harvesting has more rooting than other seasons and the harvesting in summer can be recommended to gardeners if the irrigation in summer be done completely.

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UTICAJ TIPA REZIDBE NA GUBITAKA PRINOSA KOD DVA KLONA ČAJA

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Izvod

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