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# Productivity of fruits and pasture under bael (*Aegle marmelos*) based hortipasture system

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***ABSTRACT:*** *A study was conducted to assess the productivity of fruit and perennial pasture under bael based hortipasture system. Two cultivars of bael viz; NB-9 and CISH B-2 were transplanted at 6 x 6m spacing. The understorey of each plot was intercropped with perennial pasture viz; Cenchrus ciliaris + Stylosanthes seabrana to utilized available interspace between rows. Growth parameters in terms of plant height, collar diameter, canopy spread were found to be higher in different moisture conservation treatments than control (without treatment). During the fifth year, tree height was ranged from 2.99-3.42 m in different treatments with maximum in stone mulch (3.42 m). Collar diameter was varied from 6.91-7.66 cm with maximum in stone mulch (7.66 cm) and minimum in control (6.91cm). Tree canopy varied from 1.94-2.49 m with maximum in stone mulch (2.49 m). Average pasture production (average of four years) was maximum in staggered trench (5.78 t DM/ha) with minimum in control (4.13 t DM/ha). Fruit yield in cultivar CISH B-2 varied from 1.11-1.74 t/ha and NB-9 varied from1.14-2.41t/ha.*

***Key Words:*** *Bael,* Cenchrus ciliaris, Stylosanthes seabrana, *moisture conservation practices.*

## INTRODUCTION

Hortipasture is integration of fruit trees suitable for rainfed condition with different pasture combinations in land capability class IV and V type land (Kumar and Kumar 2001). In rainfed situation mono cropping is risky enterprise because of erratic rainfall pattern. Among the fruit tree based agroforestry system, the hortipasture systems have been recognized as sustainable land use option because of its high productivity and environmental benefits even under fragile agro-ecosystem. In arid and semi arid agro ecosystem water is an important input and *in-situ* moisture conservation is a tool to provide regular moisture regime to root zone for proper growth and development of tree and pasture. Bael (*Aegle marmelos*) belongs to family Rutaceae, is an indigenous fruit tree of India. It is an important fruit species suitable for arid and semi-arid ecosystem due to deep root system, tolerance to water stress, tolerance to high and low temperature, deciduous in nature. In hot summer season leaves are dropped and plant start flowering in monsoon season and fruit matures in the month of May. Bael thrives well in almost all type of soil, including wasteland. Intercropping with suitable pasture species can bridge the gap of green and dry fodder. It can ensure food and nutritional security by supplying quality fruits for human consumption and fodder for animal resulting stability in total biomass production. (Shukla and Kumar 2007). Keeping in view the above, present study was conducted to assess the productivity of fruits and pasture under bael based hortipasture system.

## MATERIALS AND METHODS

Present study was conducted at Central Research Farm of Indian Grassland and Fodder Research Institute, Jhansi. The climate of Jhansi is semi arid with the occurrence of recurrent drought. The soil of experimental site is red. Two varieties of bael namely NB-9 and CISH B-2 was transplanted during 2008 at 6x6 m spacing. The understorey of each plot was intercropped with perennial pasture (*Cenchrus ciliaris* and *Stylosanthes seabrana*). The new seedlings of *Cenchrus ciliaris* were transplanted at 100 x 50 cm and *Stylosanthes seabrana* seed @ 4 kg /ha were sown in line between 2 rows of grass under bael tree and

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similar practice was adopted for pure pasture block. Standard package of practices were adopted for tree and pasture. The experiment consist of six treatments viz; $T_1$ Staggered trenches, $T_2$ Stone mulch, $T_3$ Water retaining chemical, $T_4$ Control (without moisture conservation), $T_5$ Sole bael, $T_6$ Sole pasture. Each treatment was replicated thrice in randomized block design.

## RESULTS AND DISCUSSION

### Tree Survival, vegetative growth and pasture yield

Based on five year observation there was consistently higher tree growth and more than 98% tree survival in different moisture conservation treatments over control (Fig. 1). Tree survival was varied from 94.65 to 98.10% in different treatment with maximum in Staggered trench (98.1%) followed by stone mulch (97.2%), water retaining chemical (96.8%) and minimum in control (94.65%). Average tree height was recorded maximum in stone mulch (2.39 m) closely followed by staggered trench (2.36 m), water retaining chemical (2.15 m) and minimum was in control (2.08 m). Maximum average collar diameter was also recorded in stone mulch (5.57 cm) followed by staggered trench (5.46 cm), water retaining chemical (5.11 cm) and minimum was recorded in control (4.76 cm). Canopy spread (average) was maximum in stone mulch (1.87 m) closely followed by staggered trench (1.78 m), water retaining chemical (1.67 m) and minimum was found in control (1.58 m). The higher tree survival and vegetative growth may be attributed to sufficient moisture regime in the root zone of tree during establishment phase. Relatively enhanced tree growth was also reported under in-situ moisture conservation practices by Kumar and Shukla (2010) in ber, Shukla *et.al* (2006) in aonla.

Average pasture yield was maximum in staggered trench (5.78tDM) followed by water retaining chemical (4.58 t DM), stone mulch (4.56 t DM) and minimum was recorded in control (4.13 t DM). Through *in-situ* moisture conservation, there was regular moisture regime in the root zone of pasture which has enhanced total biomass production. Kumar *et.al* (2009) have also reported that higher forage production in aonla through *in-situ* moisture conservation.

### Fruit yield and quality parameters

Data on yield and quality attributing traits of bael was recorded (Fig. 3) and it was found that *in-situ* moisture conservation treatment have influenced the

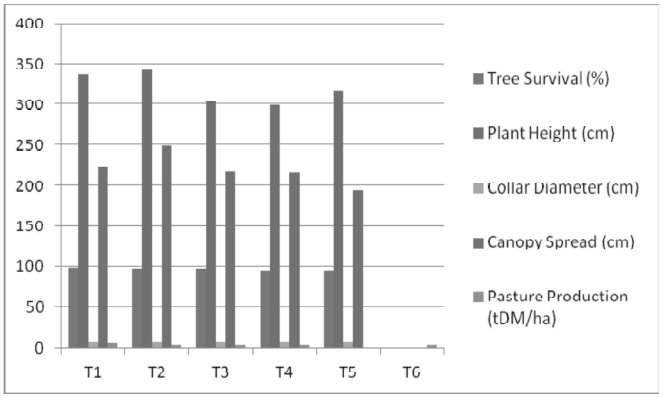


**Figure 1: Tree survival, growth and pasture yield (average of four years)**

$T_1$ Staggered trenches, $T_2$ Stone mulch, $T_3$ water retaining chemical $T_4$ control (without moisture conservation), $T_5$ sole bael and $T_6$ sole pasture.

fruit size, fruit weight and ultimately total yield of fruits. Besides, TSS and pulp content was also affected by treatment in both the cultivars. In cultivar NB-9, the highest fruit weight was recorded in staggered trench (1.85 kg) followed by stone mulch (1.56 kg), water retaining chemical (1.41 kg) and minimum was recorded in control (1.24 kg). The maximum fruit length was recorded in staggered trench (16.56 cm) followed by water retaining chemical (16.03 cm), stone mulch (15.15 cm), and lowest was recorded in control (14.22 cm). The maximum fruit breadth was recorded in staggered trench (14.95 cm) followed by stone mulch (13.58 cm), water retaining chemical (13.24 cm) and lowest was recorded in control (12.85 cm). TSS was highest in staggered trench (33.5%) followed by stone mulch (32.8%), water retaining chemical (32.3%) whereas minimum was recorded in control (31.1%). The highest pulp content was recorded in staggered trench (69.5%) and minimum was noted in (64.9%). The maximum fruit yield was observed in staggered trench (2.41 t/ha) followed by stone mulch (1.75 t/ha), water retaining chemical (1.25 t/ha) however minimum was found in control (1.14 t/ha). Seed weight has shown reverse trend and was minimum seed weight was observed in staggered trench (12.12g) and maximum in control (14.9 g).

In cultivar CISH B-2, the highest fruit weight was recorded in staggered trench (1.75 kg) followed by stone mulch (1.45 kg) water retaining chemical (1.36 kg) however, minimum fruit weight (Fig. 2) was observed in control (1.21 kg). Fruit size (LxB) was recorded in staggered trench (17.25 x 14.15 cm) followed by stone mulch ((16.15 x 13.35 cm), water retaining chemical (15.86 x 12.93 cm) and lowest was recorded in control (15.52 x 12.03 cm). The maximum

TSS was recorded in staggered trench (31.2%) followed by stone mulch (29.4%), water retaining chemical (28.5%) and minimum was observed in control (27.6%). The maximum pulp content was observed in staggered trench (62.3%) followed by stone mulch (60.2%), water retaining chemical (59.4%) whereas minimum was recorded in control (58.8%). The highest fruit yield was maximum in staggered trench (1.74 t/ha) followed by stone mulch (1.34 t/ha), water retaining chemical (1.26 t/ha) however, minimum was found in control (1.11 t/ha). Seed weight has shown reverse trend and was minimum in Staggered trench (9.1g) and maximum in control (9.9 g). Kumar and Shukla (2010) also reported the significantly increased yield and improvement in quality of Indian jujube through in-situ moisture conservation (bunding).

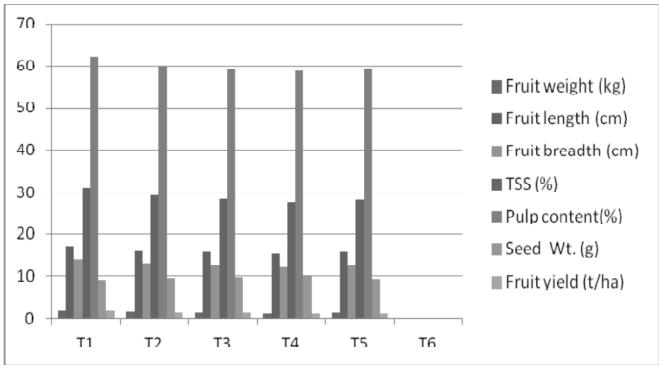


**Figure 2: Physico-chemical parameters of bael varieties (CISH B-2) under hortipastoral system with different moisture conservation**

$T_1$ Staggered trenches, $T_2$ Stone mulch, $T_3$ water retaining chemical $T_4$ control (without moisture conservation), $T_5$ sole bael and $T_6$ sole pasture

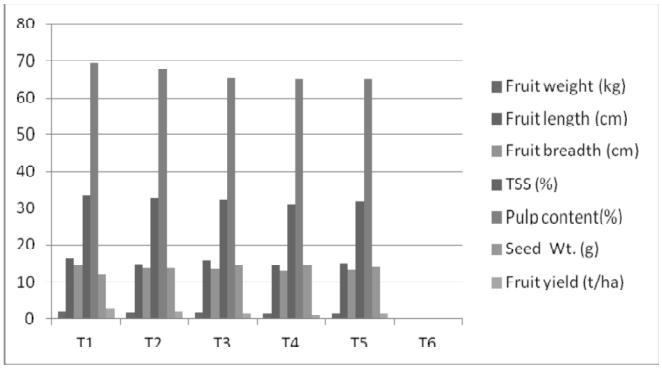


**Figure 3: Physico-chemical parameters of bael varieties (NB-9) under hortipastoral system with different moisture conservation**

$T_1$ Staggered trenches, $T_2$ Stone mulch, $T_3$ water retaining chemical $T_4$ control (without moisture conservation), $T_5$ sole bael and $T_6$ sole pasture

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