

Original Research Article

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Effect of Pruning, Strapping, Dormancy Breaking Chemical and Irrigation on Asian Pear (*Pyrus pyrifolia* L.) Grown Under Eastern Plateau of India

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A B S T R A C T

Economic yield of Asian pear (*Pyrus pyrifolia* L.) growing in subtropical –sub humid region of Ranchi can be achieved by adopting some cultural practices like girdling, pruning of current season growth up to 50 % and there by application of flowering induction hormone thio-urea (5%) in different treatment combinations. The experiments were conducted during 2006-2007 and 2013-1014 at ICAR-RCER, Research Center, Ranchi, India. In the first experiment the result revealed that increased in yield from 2.07 kg (control) to 20.64 kg in T₃ treatment [No Girdling+ Prunning+ thiourea (5%)], which is considered the best treatment on junior adult bearing plant (7-8 yrs). It was evident that either pruning or girdling with application of dormancy breaking chemical thiourea (5 %) resulted in at par yield, which indicated that unproductive pear orchards adjoining to Netrahat hills and Ranchi were required some cultural practices (training, pruning, girdling, application of dormancy breaking chemical, etc.) to become fruit full. After a long gap, during 2013 -2014 one additional treatment of irrigation from bud break to peanut stage was replaced by strapping which enhanced the production /plant remarkably. With regard to fruit quality, in first experiment, T₁ treatment [Girdling + Pruning + Thiourea (5 %)] resulted in having the highest TSS (12.2 °B) and total sugar of 6.8 % possibly due to medium sized fruit and less yield as compared to treatment T₃ and T₄ [Thio-urea (5%) + Non-pruning and Girdling]. In case of second experiment conducted during 2013-14 irrigation treatment was given followed by 50% pruning and 5% thiourea application. The treatment 1 comprising of 50% pruning and 5% thiourea application during dormancy breaking and 32 lit water/plant/week up to peanut stage from pollination markedly increased in fruit set (73 %) and the yield [77.56 kg /14 yrs plant].

Keywords

Asian Pear,
Punning,
Girdling,
Thiourea,
Irrigation and
Yield.

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Introduction

In Jharkhand pear is cultivated in and around of Netarhat hills adjoining to state capital Ranchi. Low chilling pear cultivated in low-lying areas of Ranchi, where the winter temperature is believed to be favorable for pear cultivation.

But due to global warming and insufficient of rainfall pear are difficult to flower for economic yield. Therefore, most of the pear orchards are unproductive even after plants get matured. Thiourea (1.5 per cent) was most effective to break bud rest in apple,

plum, peach and apricot in Kenyan highlands (Erez and Lavi, 1985). Thiourea (2%) induced flowering in twenty years old 'Pathernakh' pear in India (Singh and Mann, 2002). Two times spray of thiourea 5% at 15 days interval resulted in modification of C:N ratio of shoots gave maximum fruit yield in asian pear cultivar Netrahat Selection (Jana and Das, 2014). The effect of spur pruning and total defoliation in the autumn on pear trees of the cv. Nijisseiki, in the growing season 1999/2000, was conducted in the Embrapa Temperate Climate Research Center (Herter *et al.*, 2007). In the next spring during blooming the total number of flower buds and the number of buds aborted were counted and the percentage of buds aborting calculated. The control plants showed an average of 74.35% of flower bud abortion, whereas the spur pruned trees showed 54.11% and the completely defoliated 56.38% (Herter *et al.*, 2007). Some indication that biochemical signals reflecting water and nutrient conditions in the soil are transmitted from the root to the shoot to regulate plant water use, and this information will be critical to any genetic manipulation via genomics or breeding (Radin and Mauney, 1986; Clarkson *et al.*, 2000; Sobeih *et al.*, 2004). Knowledge of these response mechanisms may also be critical for optimized deficit irrigation management.

Research to determine deficit management strategies in the absence of physiological understanding will be very resource intensive. Regulated deficit Irrigation (RDI) has been applied successfully for tree crops like citrus, olives, peaches, grapevines etc (Domingo *et al.*, 1996). Endogenous plant hormones have shown the ability to affect different developmental processes in a positive or negative manner but in some processes (e.g., flower induction) there is still a need for a better understanding of these signal interactions, their origin,

transport and perception to reliably manipulate them with PBRs (Dussi, 2011). Therefore, present experiment was conducted with a view to adopt some cultural practices (pruning and girdling and application of thiourea 5%) to reduce and rectify the problems of unfruitfulness in Asian pear. Localized irrigation is widely recognized as one of the most efficient methods of watering crops (Keller and Blienser, 1990). It is well known that crop yield increases with water availability in the root zone, until saturation level above which there is little effect (Hillel, 1997). Localized irrigation is widely recognized as one of the most efficient methods of watering crops (Keller and Blienser, 1990). Primary root dryness had been successfully applied with drip irrigation in grapevines (Dry *et al.*, 2000), with subsurface irrigation in grapevines (Loveys *et al.*, 1997) and even furrow irrigation in pear, citrus and grapevines (Clancy, 1999).

Keeping this in view the present investigation (Expt-2) was designed to use irrigation in lieu of strapping which was practised in the first experiment to get maximum output from the modified treatments.

Materials and Methods

The experiment was conducted at ICAR Research Complex for Eastern Region, Research Centre, and Ranchi during 2006 and 2007. This area is situated 620 m above mean sea level (msl) and at 23⁰ 25' N latitude and 85⁰ 20' East longitude experiencing an average annual rainfall of 110-140 cm. Soil is acidic and pH range from 5.0-6.5, which is ideal for pear cultivation. Girdling with pear with wire (200 gages) just after harvesting in August was performed. 50 % pruning of current season's growth was done at dormant season

during 2nd week of December. Spraying was done on 21 January 2007. The experiment was laid out in a randomized block design with four replications. The treatments were T₁=Girdling + Pruning + Thiourea (5%), T₂=Girdling +Non Prunning + Thiourea (5%), T₃=No Girdling+ Prunning+ thiourea (5%), T₄= Thiourea (5%), + Nonprunning and Girdling and T₅ =Control. Data were taken on flowering, fruit set percentage and on fruit quality. Flowering per cent was calculated by number of flower buds over 100 total buds on a shoot. Initial fruit set was calculated after three weeks of flowering. Final fruit set percentage of replicated trees was studied after 60 days of fruit set and calculated by the following formula:

$$\text{Final fruit set (\%)} = \text{FR} * 100 / \text{AVF} * \text{NF}$$

FR= number of fruits /shoot

AVF= Average number of flowers/inflorescence

NF=Number of inflorescences /shoot

Titrateable acidity was estimated by titrating the fruit extract with 0.1 N NaOH using phenolphthalein as an indicator and expressed as per cent citric acid equivalent. TSS was recorded by hand refractrometer. Total sugars were estimated by Lane and Eynon method (Ranganna, 1996).

During 2013-14 one treatment replacement was given. Randomized block Design was also adopted in second trial. Irrigation of the crop had been done instead of stripping owing to depict the idea of ice melting in pear plants at high and mid hill region during early March-April. In second Experiment, treatments were; T₁ = Pruning+ Thiourea (5%)+Irrigation, T₂ =Non Pruning+ Thiourea (5%)+Irrigation, T₃= Pruning + Irrigation, T₄=Irrigation. Acidity, TSS, Total sugar etc was taken following above methods (Ranganna1996).



Strapping was done with 200 mm wire which was tightly binded during Autumn and gave rise to flower in March (next).

Plate.1 Strapping and spray with thiourea (5%) and flowering on main branch

Result and Discussion

Different treatments were imposed viz., strapping, pruning and application of thiourea in combinations to get maximum commercial cropping which was the urgent need for Asian pear cultivation in subtropical condition and its existence as valuable crop for the future. A close perusal of the table found that that the maximum fruit size of 236.66 gm was found in pruning and thiourea (5%) treatment under non girdling condition the maximum flowering per cent 61.07 % and yield (20.64 kg/plant) were also observed from this treatments. However, treatment combination of girdling pruning and application of thiourea resulted in 51.52 % flowering and fruit yield of 13.13 kg/plant due to drastic reduction of branches due to pruning (50 % of new shoot which give flower in the next season. But girdling was done in the base of the 3-4 years branches which did not lose any flowering spur resulted in the maximum yield of this particular treatment which was at par with the pruning and thiourea application. Pruning induced the maximum bud burst and thiourea not only induced flowering but

also helped in fruit set and thereby yield (T₃). T₁ did not perform well due to girdling which was hampered the source sink balance in fruit production processes. As fruit quality point of view, T₁ exhibited maximum TSS of 12.2 °B and total sugar of 6.7% as yield was less and fruit size was medium (Fig-3). In respect of yield T₂ =Strapping +Non Pruning+ Thiourea (5%) and T₃=No Strapping+ Pruning+thiourea (5%) were statistically at par giving yield of 19.14 kg and 20.68 kg respectively. It clearly indicated that strapping (girdling) did not have much influence on yield.

After six years of the first experiment, I thought that one factor is still missing to achieve the perfection in yield in Asian pears that grown under lower foothills of Himalayas or plains of Punjab or plateau of Jharkhand. It stucked in my mind that snow fall and its water process during late Feb to early March in lower hills areas could be the lacking principle for best yield under plateau and plains. Therefore, strapping treatment was replaced by irrigation@ 32 lits water/plant /week.

Table.1 Effect of cultural practices and application of dormancy breaking chemical on fruit yield and quality 2007

Treatments	Flowering (%)	Fruit set (%)	Fruit weight (g)	Fruit size (cm ²)	Fruit size (c.c.)	Yield (Kg /plant)
T1=Strapping+Pruning+ Thiourea (5 %)	51.52	09.81	194.66	50.44	193.33	13.13
T2 =Strapping +NonPrunning+ Thiourea (5%)	43.78	08.77	186.50	74.21	190.83	19.14
T3=No Strapping+Prunning+thiourea (5%)	61.07	12.08	236.66	57.19	220.00	20.68
T4=Thiourea(5%)+NonPrunning +Strapping	39.68	08.49	228.68	53.78	219.16	06.97
Control: No treatments and Spraying	11.78	08.81	192.86	72.86	188.12	02.07
CD at 5 %	10.56	1.82	15.64	3.91	8.55	2.48

Table.2 Effect of cultural practices and application of dormancy breaking chemical on fruit yield and quality 2014

Treatments	Floweri ng (%)	Fruit set (%)	Type Of First bud	Advanced flowering (days)	Avanced Harvesing (days)
T1 = Pruning+ Thiourea (5 %)+Irrigation	62.58	73.00	Vegetative	28.33	24.66
T2 =Non Prunning+ Thiourea (5%)+ Irrigation	43.72	38.75	Floral	10.66	8.45
T3=Prunning+Irrigation	32.45	18.75	Vegetative	14.22	13.66
T4=Irrigation	28.63	16.24	Floral	6.33	4.22
Control: No treatments and Spraying	14.74	12.67	Floral	0.0	0.0
CD at 5 %	11.54	3.14	-----	-----	-----

Table.3 Fruit Physical parameters during -2104

Treatments	Fruit weight(g)	Fruit Volume(c.c.)	Fruit length (mm)	Fruit breadth(mm)	Skin Weight (g)	Flesh Weight(g)
T1	294.16 ^a	192.91 ^a	73.25 ^a	79.17 ^a	52.52 ^a	234.57 ^a
T2	164.16 ^b	142.49 ^b	65.17 ^a	63.66 ^{ab}	62.28 ^a	101.87 ^b
T3	146.33 ^b	132.08 ^b	43.42 ^{ab}	48.65 ^b	58.45 ^{ab}	87.88 ^b
T4	132.58 ^b	122.42 ^b	59.41 ^{ab}	59.00 ^b	56.19 ^{ab}	76.38 ^b
T5	138.75 ^b	130.66 ^b	59.58 ^b	56.08 ^b	49.46 ^b	89.28 ^b
CD at 5%	78.42	40.58	17.96	16.14	14.63	77.07

Table.4 Fruit Bio-chemical parameter and Yield during- 2014

Treatments	TSS OB	Acidity	Reducing Sugar	Total sugar	Sugar acid ratio	Yield kg/plant
T1	14.25 ^a	0.173	5.605 ^a	6.243 ^a	37.57	74.62 ^a
T2	13.15 ^b	0.178	5.123 ^b	5.358 ^b	31.11	43.43 ^b
T3	11.72 ^b	0.156	4.713 ^b	4.515 ^b	32.17	38.99 ^c
T4	11.87 ^b	0.156	4.638 ^b	4.438 ^c	31.89	27.48 ^d
T5	10.90 ^b	0.172	4.675 ^b	5.368 ^c	31.16	14.99 ^e
CD at 5%	78.42	NS	0.49	0.777	1.36	6.57

Fig.1 Yield of different treatments imposed on Asian pear cv. Netrahat Selection (2006-7)

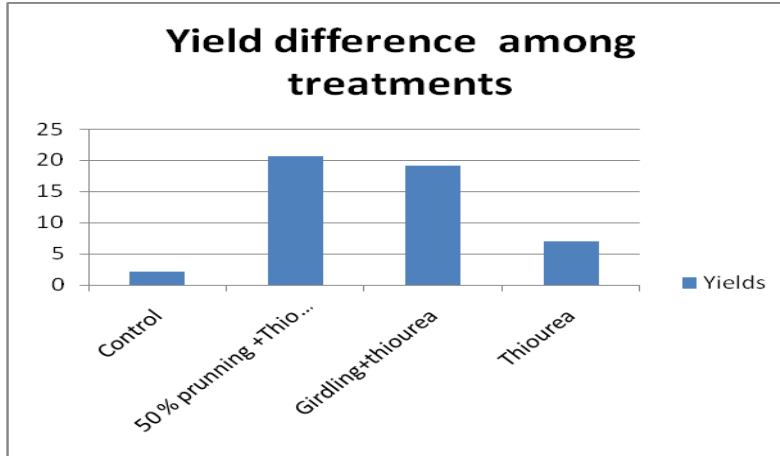


Fig.2 Influences of cultural practices on yield of unproductive pear orchards (2006-07).

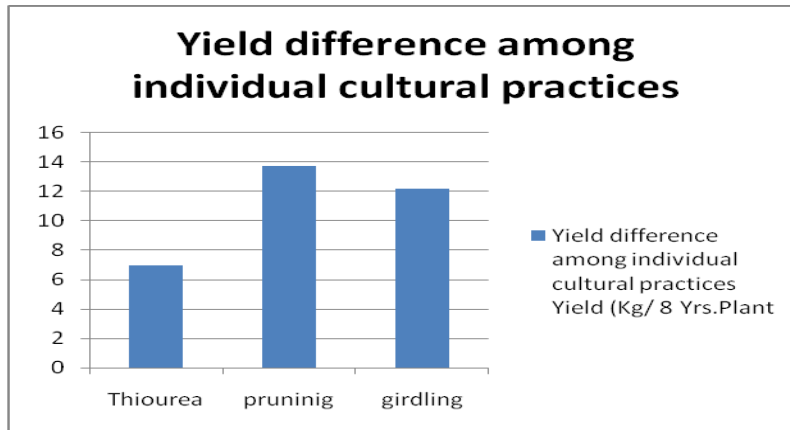


Fig.3 Fruit quality of Asian pears adopting different cultural practices (2006-07).

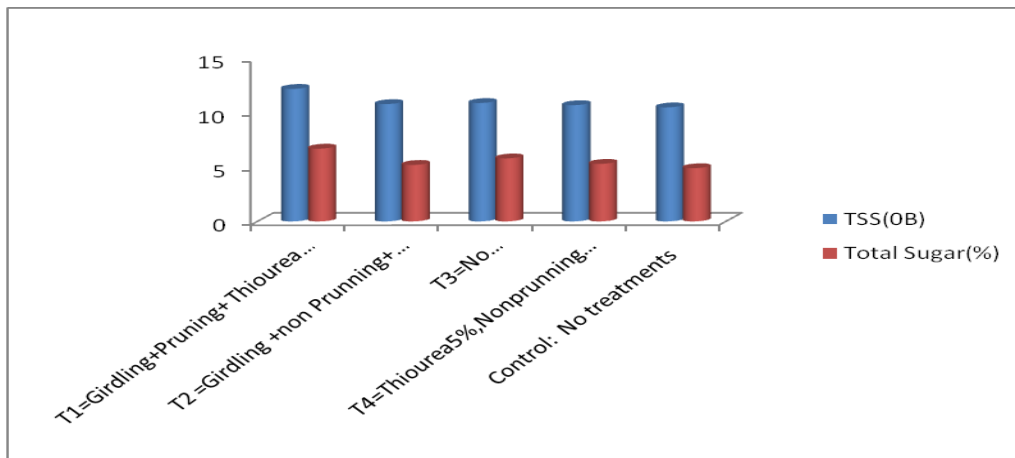


Plate.2 Heavy fruit set per cent-73.00 % during 2014.



Plate.3 Effect of growth regulators, pruning and irrigation gave the maximum yield (T1/2014)



The results were quite impressive that T₁ (T₁ = Pruning + Thiourea (5 %)+Irrigation) recorded the maximum fruit set as well as maximum production(77.56 kg/plant.) Irrigation not only mere supply of water to retain fruit set % but also provide the medium for transportation of helpful PBRs to sink for reducing fruit drop and support heavy crop load drung stress months harsh climate prevails. These results were

supported by Dussi (2011). From Fig-1 it was evident that during 2007, T₂ treatment accounted for maximum yield but in Fig-2 by partition it was evient that pruning alone comprises of the maximum yield beyond the effect of dormancy breaking chemicals. This result corroborates the findings of Herter *et al.*, (2007). TSS and total sugar that was recorded during 2007 were less but due to matured but growing plant. TSS and total

sugar was attained optimum for this cultivar particularly in second experiment. It may be due to fruits attained peak harvest time. Apart from this, sugar acid ratio of 37.57 was found in T₁ treatment (table-4) of the second experiment which clearly indicated that (T₁) Pruning+ Thiourea (5%)+Irrigation was the best treatment for commercial pear production under plateau and plains of Eastern Regions. These results were corroborated by, Domingo *et al.*, (1996) and Hillel (1997). Pruning increases vegetative growth where as thio-urea increases C:N ration of shoot and irrigation teaming up the deficient irrigation leading to maximum crop production [Keller and Blienser (1990) and (Jana and Das 2014)]. Along with dormancy breaking chemicals

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