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Influence of double pruning in a year and fertilizer application time on yield and quality parameters of phalsa (*Grewia asiatica* L.) cv. local

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Abstract
The present investigation entitled "Influence of double pruning in a year and fertilizer application time on yield and quality parameters of phalsa (*Grewia asiatica* L.) cv. Local was carried out in the year 2019 at horticultural research farm, Anand Agricultural University, Anand. The result of present study regarding effect of double pruning and fertilizer application time on phalsa. Study showed results that treatment P_5 i.e. double pruning during December and May was found significant with lower no. of fruits/100gm (130.95) and higher juice (46.62%). However, total soluble solids (21.65 ºbrix) and total sugar (6.05%) was found significant with double pruning in treatment P_3 (October and March) and P_2 (September and February), respectively. Weight of fruit/plant was found significant with double pruning in the month of August and January i.e. 4.44 kg/plant. Treatment F_1 i.e. single split of fertilizer (one time) application found significant with total sugar i.e. 5.75%.

Keywords: Pruning, single, double, growth, fertilizer

Introduction
The phalsa (*Grewia asiatica* L.) belongs to the family Tilliaceae. Botanically the fruit is a berry, highly delicious, sour to sweet in taste with a desired pleasant flavour. Phalsa fruit has a short shelf life and is considered suitable only for local marketing (Anand 1960) [1]. In Gujarat it is grown in some parts of Ahmedabad, Vadodara, Kutch, Valsad and Saurashtra region.
Ripe fruits contained 50-60 per cent juice and good source of vitamin A and C. They are also a fair source of phosphorus and iron. There is no any distinct variety available in phalsa; some growers have, however given names as 'Local' and 'Sharbati'.
The most important operation in the cultivation of phalsa is pruning. In South India, no pruning is practiced (Singh and Sharma, 1961) [8]. On other hand in North India and in Andhra Pradesh, some fruit growers cutting the plant or burning them to the ground level. This practice is also followed in Kutch area of the Gujarat state (Singh and Singh, 1983) [9]. Jadhav (1993) [10] carried out the experiment of double cropping system in phalsa. They have tried winter as first off season crop and second regular crop in summer on the same bushes along with traditional single crop.
He reported that by two times pruning i.e. August and January in a year resulted to increase in productivity also suggested that only winter season crop was not found economical, however, the total of double cropping system was found desirable.
On the basis of them research, two crops in year from one plant is possible and need to take research with different months combination for identify suitable period and time for double crops with their effect on quality and total production of phalsa crops.

Materials and Methods
The experiment was carried out in the year 2019 on seven years old phalsa plants of variety 'Local' planted at Horticultural Research Farm, Anand Agricultural University, Anand. All the plants selected were uniform in growth and planted at the distance of 3 ×3 meters. The climate of Anand region is semi-arid and sub-tropical type. Winter is mild cool and dry, while summer is hot and dry.
The experiment was laid out in a Completely Randomized Design (Factorial) with ten treatment combinations of two factor. 1) Pruning time (P_1= August and January, P_2= September and February, P_3= October and March, P_4= November and April, P_5= December

and May) on the same plant and 2) Fertilizer application (F_1= Single split of RDF at time of 1st pruning and F_2= double split of (50% + 50%) RDF at the time of 1st and 2nd pruning) and control treatment i.e. pruning only once, replicated for four times and it carried out at 1m height from the ground during the 1st week of particular month.

Experimental Results

Effect of double pruning

The data presented in table-1 indicate that during the 1st pruning of August to December, significantly lower number of fruits/100gm was recorded during the month of December (132.12), similarly during 2nd pruning of January to May, lower no. of fruits/100gm was observed under the month of May (129.75). While, on the basis of mean of both pruning, significantly lower no. of fruits/100gm was recorded under the treatment P_5 i.e. December and May (130.93). Fruit size is directly correlated with growing condition and environment during the growing period. Phalsa fruit is generally preferred summer season for ideal growth and development of the fruits. These findings are in accordance with Chundawat *et al.* (1976) [2] and Rao and Reddy (1989) [7] in phalsa.

1st pruning during the month of August to December, weight of fruit/plant recorded higher in the month of December (2.85 kg/plant). While, on 2nd pruning during the month of January to May it was recoded higher weight of fruit/plant during the month of January i.e. 2.55kg/plant. On the basis of both the pruning total weight of fruit/plant in 1 year was recorded with treatment P_1 (August and January) i.e. 4.44 kg/plant. Which was nearly double than single pruning. An increase in weight of fruit per tree might be due to favourable condition during growing of the fruits during summer and pre winter season encouraged vegetative growth and followed by fruit growth. This findings are accordance with those of Chundawat *et al.* (1976) [2], Ghaffoor *et al.* (2001) [3] and Meghwal (2006) [6] in phalsa crop.

Quality parameter like total soluble solids in the 1st pruning during the August to December, it was recorded significantly higher in December (20.68 °brix). While, during the 2nd pruning during the January to May it was recoded higher in the month of March (23.12 °brix). Similarly, mean data recorded significantly higher total soluble solids with the treatment P_3 (October and March) i.e. 21.65 °brix. Similar results were also obtained by Singh and Sharma (1961) [8], Jadav (1993) [10] in phalsa and contradictory with Ghosh *et.al* (2019) [4].

Data recorded for total sugar (%) in the 1st pruning during the August to December, it was higher in the month of December (5.92%), while, during the 2nd pruning (January to May) it was recorded higher in the month of January (6.70%). On the basis of mean data, total sugar (%) was significantly recoded higher with the treatment P_2 (September and February) i.e. 6.05%. Result indicate that fruit develop during early summer have higher total sugar and this finding is in agreement with the results of Ghosh *et al.* (2019) [4] and Singh and Sharma (1961) [8], they observed the higher sugar in moderate pruning during December and January.

Data pertaining to juice (%) in the 1st pruning during the August to December, it was found significantly higher in the month of December (46.50%), while in 2nd pruning (January to May) it was higher in the month of February (48.00%). On the basis of mean data, juice (%) was recorded significantly higher with treatment P_5 (December and May) i.e. 46.62%. This might be due to requirement of the phalsa crop are fulfilled by atmosphere. This findings are accordance with those of Chundawat *et al.* (1976) [2], Ghaffoor *et al.* (2001) [3] and Meghwal (2006) [6] in phalsa.

Fertilizer applicatio

With respect to fertilizer application time in three parameters i.e. no. of fruits/100gm, total soluble solids (°brix) and juice (%) effects were found non-significant in 1st and 2nd pruning as well as in mean of it. It's indicate that application of fertilizer either in single split or in double split were not making any change in no. of fruits/100gm, total soluble solids (°brix) and juice (%) parameters. However, on the basis of mean data, total sugar (%) was recorded significantly higher with treatment F_1 (single split) i.e. 5.78%.

While, numerically higher value for total soluble solids (°brix) i.e. 19.50 °brix, were observed under the double split of fertilizer in 1st pruning. Similarly, for the weight of fruit/plant also higher with the double split of fertilizer application in 1st (2.03kg/plant) and 2nd pruning (1.47kg/plant) as well as higher in total (3.50kg/plant) i.e. double pruning/year.

Table 1: Effect of double pruning and fertilizer application time on yield and quality parameters of phalsa crop.

Treatment	No. of fruits/100gm			Weight of fruit/plant (kg/plant)			Total soluble solids (^{0}Brix)			Total Sugar (%)			Juice (%)		
	1st Pruning	2nd Pruning	Mean	1st Pruning	2nd Pruning	Total	1st Pruning	2nd Pruning	Mean	1st Pruning	2nd Pruning	Mean	1st Pruning	2nd Pruning	Mean
Double Pruning															
P_1 (Aug & Jan)	140.00	142.00	141.00	1.89	2.55	4.44	17.93	18.37	18.15	4.53	6.70	5.61	43.50	46.62	45.06
P_2 (Sept & Feb)	142.50	143.62	143.06	1.63	2.12	3.75	18.06	22.25	20.15	5.53	6.57	6.05	43.50	48.00	45.75
P_3 (Oct. & March)	142.37	140.12	141.24	1.76	1.49	3.25	20.18	23.12	21.65	4.81	5.17	4.99	42.87	42.37	42.62
P_4 (Nov & April)	135.87	132.37	134.12	1.83	0.52	2.35	18.87	20.93	19.90	5.83	6.01	5.92	37.37	44.87	41.12
P_5 (Dec & May)	132.12	129.75	130.93	2.85	0.42	3.27	20.68	21.50	21.09	5.92	5.58	5.75	46.50	46.75	46.62
S.Em ±	1.57	1.41	1.05	--	--	--	0.26	0.38	0.23	0.13	0.16	0.10	0.72	1.01	0.62
$Lsd_{0.05}$	4.54	4.07	2.99	--	--	--	0.75	1.11	0.65	0.39	0.48	0.30	2.08	2.91	1.75
Time of Fertilizer application															
F_1 (Single split)	138.90	138.00	138.45	1.94	1.36	3.30	18.80	21.20	20.00	5.45	6.12	5.78	42.40	45.30	43.85
F_2 (Double split)	138.25	137.15	137.70	2.03	1.47	3.50	19.50	21.27	20.38	5.21	5.90	5.55	43.10	46.15	44.62

S.Em ±	0.99	0.89	0.66	--	--	--	0.16	0.24	0.14	0.08	0.10	0.06	0.45	0.63	0.39
$Lsd_{0.05}$	NS	NS	NS	--	--	--	0.47	NS	NS	NS	NS	0.19	NS	NS	NS

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