Short Communication

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Effect of different methods of defoliation on growth, flowering and yield in lasora (*Cordia myxa* L.)

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Lasura (*Cordia myxa* L.) popularly known as Gonda or Lehsua is an underutilized fruit crop grown in arid and semi arid region of India and worldwide. In Rajasthan, flowering occurs in 10th March to 23rd April under Jodhpur condition with new leaves (Vashishtha *et al.*, 1985). In Rajasthan especially in western Rajasthan demand of lasura fruit is increases near the festival of 'Holi' or in month of March. But, the availability of fruit in market is in month of May. Defoliation of leaves in lasura in the month of December-January produces early flowering and fruiting in arid region. (Sharma *et al*., 2013). So, the growers use traditional or manual method of defoliation to advance the crop without use of any chemicals. An overriding need exists to develop new and modern system to advance the crop to increase yield.
Therefore, to achieve desired production at desired period of time defoliation is one of the most important factor.

Eight year old plants of lasura, planted 6×6 m apart at orchard at Agriculture Research Station, Mandor, Agriculture University, Jodhpur during the year 2016-17 were selected for the study, single plant considered as an experiment unit was replicated three times in Randomized Block Design with eight treatments. The treatments consisted of Manual defoliation, Thiourea 5g + Ethephon 2ml + DAP 5g ltr^{-1}, Thiourea 7.5g + Ethephon 3ml + DAP 7.5g ltr^{-1}, Thiourea 10g + Ethephon 4ml + DAP 10g ltr^{-1}, Ethephon 4ml ltr^{-1}, 2,4-D 3ml ltr^{-1}, 2,4-D 4ml ltr^{-1} and water is sprayed as control. Observations were recorded on physical parameters, flowering and yield of crop during experimental period. Physical parameters (i.e. defoliation % at 10, 20 and 30DAT, burning of tips, days taken in 80% defoliation, sprouting after defoliation, length of sprout at 30, 45 and 60 days after sprouting and leaf area) were recorded after recording initial observations in each treatment. Five newly emerged shoots were selected and tagged randomly in each treatment for measuring burning, length of sprout same as five fully developed leaves from each treatment were selected for leaf area. Days taken to 80 per cent defoliation, sprouting after defoliation and flower initiation were recorded by visual observation through regular visiting the orchard. The Number of flowers was counted on five selected branches and average numbers of flowers per branch were calculated. Total number of flowers which set into fruit were counted and per cent fruit set was calculated on the basis of number of flower emerged. Number of days taken to maturity stage of fruit from date of defoliation was counted as maturity of fruits days after defoliation. The yield/plant was calculated by sum of weight obtained from all the pickings and yield/ha. was calculated by multiplying the yield per plant with number of plants (278) per ha. Fruit weight was calculated by average of five fruits from each treatment. Statistical analysis was carried out as per methods prescribed by Panse and Sukhatme (1985).

The analysis of data on physical parameters, flowering and yield as influenced by different defoliation methods are presented in table-1 & 2.

Physical parameters and flowering

It is revealed from the data presented in table there is significant effect of all the methods on physical parameters and flowering. Manual method of defoliation recorded significantly higher defoliation per cent (100%). Defoliation per cent is also significantly increased with T.U. 10g + Ethephon 4 ml + DAP 10 g ltr^{-1} (88%) followed by lower concentration of T.U. + Ethephon + DAP and Ethephon. Similar effect of defoliation was reported in pomegranate by Sheikh (2014). It might be because of abscission regulating hormone ethylene. Abscission zones of most abscising organs like leaves are highly sensitive to ethylene with only a few reports of ethylene insensitive abscission, reported by Van Doorm (2001). Manual method of defoliation recorded minimum days to defoliation (1 day). Among chemical methods T.U. 10g + Ethephon 4 ml + DAP 10 g ltr^{-1} recorded 6.33 days for defoliation. The results are in accordance with the findings of Sheikh, 2014. They found 84.33 per cent defoliation after 21 days in pomegranate. The maximum burning of tips was recorded with all the concentration of 2,4-D (11% and 19.57%). Because if the above-ground parts of the plant are sprayed or dusted with 2,4-D, the response is different, for leaf growth ceases, the rate of respiration of the plant is increased, and its reserve food materials are broken down and subsequently burned up. This study is supported by Mitchell (1947). Results showed that minimum days in sprouting (9.67) and flower initiation (16) was recorded with control because growth was initiated just after defoliation in lasura tree, this was supported by Vashishtha *et al*. (1985). But flowering with natural defoliation occurs late in month of

April. Among all the chemical treatments T.U. 10g + Ethephon 4 ml + DAP 10 g ltr^{-1} recorded earliest sprouting (14.67 days) and earliest flower initiation (25 days) is caused due to use of dormancy breaking and flower initiative chemicals *viz.* Thiourea and Ethephon. Thiourea increases starch content of cells (Rahman *et al*., 2002) and alters the protein structures (Pandey *et al.* 2013) there by increases C:N ratio of cell which broke dormancy. Application ofethephon found effective for induction of early flowering. Ethephon release ethylene when come in contact with the plant tissue. This in turn, triggers the mechanism of flowering and brings the shoots to flowering. These results were also recorded in pomegranate (Sheikh, 2014, Chandra *et al.*, 2011), in many fruit crops (Tandel *et al.*2010), in mango (Dalal *et al.* 2005), in custard apple (Vinay *et al.*2015), in Asian pear (Jana and Das, 2014) and in guava (Hiremath *et al.*, 2017). Application of thiourea can induce flowering in certain varieties of mango (Nartvaranant *et al.*, 2000). maximum length of sprout (41.53, 48.77 and 54.73 cm) at 30, 45 and 60 days after sprouting was recorded with treatment T.U. 10g + Ethephon 4 ml + DAP 10g ltr^{-1} while minimum length was recorded with both the concentration of 2,4-D. This result gets full support from Chandra *et al.* (2011) and Sheikh (2014). High concentration of 2,4-D can inhibit cell division and growth (Tu *et al.*2001). The number of flower maximum in treatment ethephon 4ml ltr^{-1} (222, 310.67 and 378) was found and the minimum no. of flower was recorded in 2,4-D 4 ml ltr^{-1} (53.67, 91 and 166.33) at 30, 45 and 60 DAD, respectively. Similar findings are found in custard apple by Vinay *et al* (2015) that defoliated plants with ethephon 2000 ppm recorded significant number of flowers on 30, 60 and 60 DAT and similar results were observed in guava by Jain and Dasora (2007) that 250 and 500 ppm ethrel recorded maximum number of flowers per shoot. Treatment T.U. 10g + ethephon 4ml + DAP 10 g ltr^{-1} recorded maximum leaf area (72 cm^2) followed by T.U. 7.5g + ethephon 3ml + DAP 7.5 g ltr^{-1} (67.67 cm^2) which were on par with each other. Minimum leaf area 20 cm^2 was recorded with 2,4-D 4 ml ltr^{-1}. Mitchell (1947) reported that presence of 2,4-D on young leaves prevent it from expanding, and new leaves curled up and become distorted. Chemical caused a quick check in growth of leaves. Treatment T.U. 5g+ Ethephon 2ml + DAP 5g ltr^{-1} recorded maximum fruit set (20.78%) which is at par with T.U. 7.5g+ Ethephon 3ml + DAP 7.5g ltr^{-1} (20.77) and treatment T.U. 10g+ Ethephon 4ml + DAP105g ltr^{-1} (19%). Minimum fruit set percentage was recorded with control (9.03%). This result get full support from Jana and Das (2014) on Asian pear, it was also proved in custard apple by Vinay *et al.* (2015) and in mango cv. Langra by Koruna *et al.* (2007). Contrary to this Singh and Reddy (1997) reported maximum reduction in fruit set with 1800 ppm ethephon in guava crop. Data revealed that treatment with high concentration of ethephon cause early maturity in lasura fruits. Treatment T.U. 10g + ethephon 4ml + DAP 10g ltr^{-1} recorded minimum days (55.40) in maturity closely followed by ethephon 4ml ltr^{-1} (55.47) and treatment T.U. 7.5g + ethephon 3ml + DAP 7.5g ltr^{-1} (57.57) which were at par with each other. Maximum days for maturity were recorded with control (64.80). These results are in confirmation with results obtained by Aroosa *et al.*(2005) on plum, on mango by Singh and Dwivedi (2009) and on pomegranate by Rathod *et al.* (2017) by the use of ethephon and by Patel *et al.* (2016) on mango by use of thiourea. Early maturity provides opportunities to have the commercial advantages of early marketing in season which fetches a higher price of fruit. The maximum number of fruits (8426.68) was recorded with manual method. Among chemical treatment ethephon 4 ml ltr^{-1} recorded maximum number of fruits followed by Treatment T.U. 10g + ethephon 4ml + DAP 10g ltr^{-1} (7455.97) which were at par with each other. Minimum number of fruits was recorded with control (4889.77). Results related to maximum number of fruits confirmed by Mishra *et al.* (2014), by Murthy (2014) in pomegranate and by Supe *et al.* (2015). maximum fruit weight was recorded with treatment T.U.7.5g + ethephon 3ml + DAP 7.5g ltr^{-1} (8.19g) closely followed by T.U. 5g + ethephon 2ml + DAP 5g ltr^{-1} (8.12g) and T.U. 10g + ethephon 4ml + DAP 10g ltr^{-1} (7.85g) which in term at par with each other whereas, minimum fruit weight was recorded with control (6.39g). These findings are in accordance with findings of Jana and Das (2014); Jana (2016) with thiourea, George (2007); Murthy (2014); Rathod *et al.*(2017) with ethrel.

Yield

Data regarding yield per plant and per ha shows significant effects of different treatment. Data shows that maximum yield per plant was recorded with T.U. 10g + ethephon 4ml + DAP 10g ltr^{-1}(58.40 kg) whereas, minimum yield were recorded with control (31.23 kg). Among all the treatments T.U. 10g + ethephon 4ml + DAP 10g ltr^{-1}(16235.20 kg) recorded maximum yield per ha however, minimum yield per ha was recorded with control (8682.87 kg). A great number of studies provide evidence regarding efficacious role of foliar applied of thiourea and ethephon in modeling physiological mechanism and improving final yield. These findings are confounding with Jana and Das (2014) and Jana (2016) reported that application of thiourea resulted in modification of C:N ratio of shoots gave maximum fruit yield in asian pear. Significant results were found by Murthy (2014); Elkhishen (2015); Supe *et al*. (2015); Rathod *et al*. (2017) in reference to yield in with ethephon.

Table1. Effect of different defoliation methods on physical parameters

Treatment	Defoliation percentage			Burning of tips (%)	Days taken in 80 per cent defoliation	Sprouting after defoliation (days)	leaf area (cm)^2	Length of sprout		
	10 D.A.T.	20 D.A.T.	30 D.A.T.					30 days after sprouting	45 days after sprouting	60 days after sprouting
T_1 Control	0	0	0	0	69	9.67	60	29.67	38.53	45.13
T_2 Manual	100	100	100	0	1	15	58	38.37	44.77	51.18
T_3 T.U. 5g+Ethephon 2ml+DAP 5g ltr^{-1}	50	73	75.33	0	40	20.67	49	36.33	43.43	52.23
T_4 T.U. 7.5g +Ethephon 3ml+DAP 7.5g ltr^{-1}	79	82	82.66	2.53	12	16.67	67.67	35.6	41.83	49.24
T_5 T.U. 10g +Ethephon 4ml+DAP 10g ltr^{-1}	87	88	88	3	6.33	14.67	72	41.53	48.77	54.73
T_6 Ethephon 4 ml ltr^{-1}	49	64	66	0	48.67	18.67	53.33	27	31.13	39.27
T_7 2,4-D 3ml ltr^{-1}	18	24.33	38.33	11	60	23	32	14.67	21.3	27.33
T_8 2,4-D 4ml ltr^{-1}	18.33	26.67	47	19.57	55.33	27	20	21	24.1	31.36
SEM+	1.75	1.78	1.99	0.26	1.29	1.09	3.77	1.38	1.56	1.51
C.D. at 5%	5.32	5.39	6.06	0.81	3.94	3.30	11.45	4.18	4.73	4.61

Table 2. Effect of different methods of defoliation on flowering and yield parameters

Treatment	Number of flowers per branch			Fruit set (%)	Maturity of fruit days after defoliation	Numbers of fruits per plant	Fruit weight (g)	Yield per plant (kg.)	Yield kg ha^{-1}	Flower initiation (DAD)
	(30DAD)	(45DAD)	(60DAD)							
T_1 Control	103	128.33	213.33	9.03	64.80	4889.77	6.39	31.23	8682.87	16
T_2 Manual	107.67	148.33	263	17.4	62.60	8426.68	6.72	56.80	15734.80	21.67
T_3 T.U. 5g+Ethephon 2ml+DAP 5g ltr^{-1}	120	157.33	241.67	20.78	58.70	6516.97	8.12	52.93	14715.47	27.67
T_4 T.U. 7.5g +Ethephon 3ml+DAP 7.5g ltr^{-1}	114.67	161.67	257.33	20.77	57.57	6780.07	8.19	55.50	15429	23
T_5 T.U. 10g +Ethephon 4ml+DAP 10g ltr^{-1}	142.67	205	311.67	19	55.40	7455.97	7.85	58.40	16235.20	20
T_6 Ethephon 4 ml ltr^{-1}	222	310.67	378	15.4	55.47	7704.25	6.32	48.67	13529.33	25
T_7 2,4-D 3ml ltr^{-1}	87.67	119.67	200.67	13.77	64.53	5473.27	6.97	38.20	10619.60	28.67
T_8 2,4-D 4ml ltr^{-1}	53.67	91	166.33	15.67	63.70	5418.47	6.48	34.83	9683.67	29.67
SEM+	6.63	5.20	7.58	0.73	1.85	294.06	0.21	1.67	465.90	1.44
C.D. at 5%	20.11	15.78	22.99	2.23	5.62	891.96	0.65	5.08	1413.16	4.38

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