EFFECT OF POTTING MIXTURE AND UREA SPRAY ON THE HEIGHT AND COLLAR DIAMETER OF TRIFOLIATE (*Poncirus trifoliata*) ROOTSTOCK

I.P. Gautam, K.P Upadhyay D.N. Sah and B. Khatri
Agriculture Research Station, Lumle, Nepal Agriculture Research Council

ABSTRACT

The experiment was conducted in a RCBD with two factorial treatments arrangement. Five rootstocks grown in five poly-pots represented a treatment and it was replicated thrice. The mixtures of different ratio of soil, FYM and sand were filled in 13x7 cm size of poly pots. Seedling of trifoliate rootstocks were transplanted in poly pots on 17th May, 2001.The effect of different potting mixture combinations and urea concentrations showed a non significant different in height of trifoliate rootstock. However, different concentration of urea spray showed a significant difference in height. The highest rootstock height (34.06, 36.63 and 41.48 cm) was observed in the treatment N_4 (3.5 g urea /lit. water sprayed at one month interval) after 4,5 and 6 months of potting respectively. Also there was a significant difference in collar diameter of trifoliate rootstocks due to the different ratio of potting mixtures. The largest collar diameter (0.68 cm) was observed due to treatment SP_2 (containing 2 part soil: 1 part FYM: 3 part sand) after 6 months of potting. However, the effect of urea spray and their combination with potting mixtures showed no significant difference in collar diameter. From this experiment, it is concluded that proper potting mixtures in combination with urea spray will be imperative in raising appropriate size of trifoliate rootstocks for grafting purposes in optimum time period.

INTRODUCTION

Citrus is an important and indispensable fruit crops grown in the mid hills of Nepal. It covers about 25 percent in total area under fruit cultivation (Shrestha and Verma, 1998). At present, the area under citrus cultivation is about 15,940 ha and production is estimated to be 93,046 Mt. Among many citrus species grown in Nepal, Mandarin (*Citrus reticulata*) is the most important one. It accounts about 58 percent area under citrus cultivation (MOA, 1997). Keeping its importance in view, Agriculture Perspective Plan (APP) has put this crop on a priority list of high value crop (APP, 1995). However, the productivity of citrus is very low in Nepal as compared to other developed countries of the world.

There are many factors, which are responsible for low productivity of citrus in Nepal. Among them unavailability of true to type genotype, good quality and disease resistance seedlings are the important yield limiting factors. Most of the seedlings supplied by the private nurseries are mainly seed propagated, which come in to bearing only after 5-8 years of planting, produces highly variable trees and suffer from various soil borne and vector transmitted diseases. Besides these, seed propagated trees suffer from hard soil pan, soil acidity, drought, coldness, water logging during rainy season, poor plant nutrition and poor orchard management. To overcome these problems, different rootstocks are recommended for budding and grafting to produce true to type and good quality seedlings, which come to bearing in a short period of time.

Among different rootstocks recommended, Trifoliate (*Poncirus trifoliata*) has become popular due to its hardiness to cold, dwarf character and resistance to soil borne diseases, gummosis, root rot, collar rot, white root rot and nematodes (Shah, 1992). It is also tolerant to tristeza virus and improves fruit quality of mandarin orange.

In-spite of its good characters, the use of this rootstock is restricted only in some government farms and research stations due to its slow growth habit, which takes at least two years to become ready for grafting and budding. Little attempts have been done in past to standarise trifoliate rootstock production in different media in Nepal. Therefore, a trial was carried out at Lumle to investigate the effect of different potting mixtures and urea spray on the plant height and collar diameter growth of trifoliate rootstock.

MATERIALS AND METHODS

The experiment was conducted at the ARS, Lumle during 2000/2001 at an elevation of 1400 masl. The trial was conducted in Randomised Complete Block Design (RCBD) with two factorial treatments arrangement. Five rootstocks grown in poly-pots represented a treatment and were replicated thrice. The levels of different factors and their combinations were as follows:

Factor1: Composition of different part of materials used in potting mixture.

Potting mixture	Part of soil	Part of FYM	Part of Sand
SP_1	1	3	2
SP_2	2	1	3
Sp_3	3	2	1

Factor2: Urea spray at one-month interval

Symbol	Amount of urea spray/ lit. water at one-month interval
N_0	Control (Only water spray)
N_1	0.5 Gram urea/ lit. water
N_2	1.5 Gram urea/ lit. water
N_3	2.5 Gram urea/ lit. water
N_4	3.5 Gram urea/ lit. water

Before mixing the different ratio of soil, FYM and sand, they were sieved through a square wire mesh hole of 2.5 cm to separate stones, gravel and large clumps. After that they were mixed thoroughly according to treatments. The mixture of these potting mixture was half filled firmly in 13 x 7-cm size poly pots. Five months old seedlings of trifoliate were transplanted in poly pots on 17 May, 2001 and again filled the mixture in poly pot leaving 2-cm head space for irrigation. Filled pots with trifoliate rootstocks were placed under the shade for further observation. Nitrogen, in the form of urea, was sprayed in different concentration as treatment described above. Observations were recorded on initial height and collar diameter at the time of potting and at intervals of one month up to six months after potting.

RESULTS AND DISCUSSIONS

Rootstocks Height

The effect of different composition of potting mixture and amount of urea spray on the plant height of Trifoliate rootstocks are presented in Table 1. The analysis of covariance presented in Table 1 clearly indicated that there was no significant different in height of the rootstock due to the different potting mixture ratio at 3, 4, 5 and 6 months after potting. However, lowest plant height was observed in SP_1 treatment (1 part soil, 3 part FYM and 2 part sand) in all months after planting. It may be caused by very friable and aerated potting mixture. This might have resulted large air space than water space, which could not retain water for long time. In return, lowest plant height might have resulted due to poor nutrients and water uptake. This finding is in agreement with findings of Subedi *et.al* (1994).

The effect of nitrogen sprays in the form of urea showed a significant difference in the plant height of trifoliate rootstocks after 4, 5, and 6 months of potting. The highest rootstock height (34.06, 36.63 and 41.48 cm) was observed in the same treatment N_4 (3.5 gm urea /lit. water sprayed at one month interval) after 4, 5 and 6 months of potting, respectively. Where as the lowest plant height was recorded in N_0 treatment in all months except 5 months after potting. It could be due to low level of nitrogen in potting mixture.

The interaction effect of potting mixture and urea showed a non-significant effect on height of the trifoliate rootstock. The combined effect of different potting mixtures and different concentration of urea spray on rootstocks height at 6 months after potting is presented in Figure 1.

Table 1: Mean height (cm) of trifoliate rootstock at different months after potting

Factor \ Treat	N_0	N_1	N_2	N_3	N_4	Mean	CV %	p value	LSD
At potting time									
SP_1	18.93	12.61	11.43	13.10	19.30	15.08	16.6	Soil part: <0.001	2.949
SP_2	22.57	26.13	24.80	26.10	28.30	25.58		Nitrogen: 0.156	3.000
SP_3	33.67	30.53	29.20	29.47	30.90	30.75		SPXN : 0.346	6.595
Mean	25.06	23.09	21.81	22.89	26.17	23.80			
3 Month after potting									
SP_1	25.41	25.41	23.37	26.71	27.16	25.61	10.4	Soil part: 0.065	4.138
SP_2	27.94	31.76	30.17	32.27	34.84	31.4		Nitrogen: 0.056	3.082
SP_3	32.13	32.77	29.61	32.79	34.78	32.42		SPXN : 0.928	6.026
Mean	28.5	29.98	27.72	30.59	32.26	29.81			
4 Month after potting									
SP_1	26.66	26.21	24.42	28.42	29.37	27.02	9.9	Soil part: 0.059	4.184
SP_2	28.8	33.86	32.48	34.77	35.86	33.15		Nitrogen: 0.040	3.116
SP_3	34.25	34.08	32.01	35.32	36.93	34.52		SPXN : 0.862	6.092
Mean	29.9	31.38	29.64	32.84	34.06	31.56			
5 Month after potting									
SP_1	27.89	27.2	25.21	30.63	32.16	28.62	9.4	Soil part: 0.065	4.205
SP_2	30.39	35.83	33.31	37.18	37.45	34.83		Nitrogen: 0.005	3.131
SP_3	35.54	35.94	34.62	37.45	40.3	36.77		SPXN : 0.853	6.123
Mean	31.27	32.99	31.05	35.08	36.63	36.41			

Factor \ Treat	N_0	N_1	N_2	N_3	N_4	Mean	CV %	p value	LSD
6 Month after potting									
SP_1	31.73	35.39	32.4	36.1	40.95	35.31	10.3	Soil part: 0.340	5.19
SP_2	36.39	39.13	37.52	41.51	41.82	39.27		Nitrogen: 0.008	3.865
SP_3	35.86	38.68	37.3	40.05	41.67	38.71		SPXN : 0.988	7.557
Mean	34.66	37.73	35.74	39.22	41.48	37.77			

Table 2: Mean girth diameter (cm) of trifoliate rootstock at different months after potting

Factor \ Treat	N_0	N_1	N_2	N_3	N_4	Mean	Cv	p value	LSD
At time of potting									
SP_1	0.28	0.22	0.26	0.26	0.29	0.26	9.1	Soil part: <0.001	0.022
SP_2	0.30	0.36	0.34	0.34	0.34	0.34		Nitrogen: 0.259	0.028
SP_3	0.39	0.38	0.36	0.32	0.35	0.37		SPXN : 0.008	0.049
Mean	0.33	0.32	0.32	0.31	0.34	0.32			
3 month after potting									
SP_1	0.52	0.54	0.41	0.47	0.47	0.50	7.3	Soil part: 0.002	0.049
SP_2	0.51	0.55	0.56	0.58	0.57	0.55		Nitrogen: 0.299	0.039
SP_3	0.55	0.61	0.57	0.58	0.61	0.58		SPXN : 0.160	0.077
Mean	0.52	0.56	0.54	0.55	0.55	0.54			
4 month after potting									
SP_1	0.54	0.56	0.52	0.49	0.50	0.52	5.8	Soil part: <0.001	0.042
SP_2	0.52	0.57	0.60	0.60	0.60	0.58		Nitrogen: 0.048	0.033
SP_3	0.57	0.65	0.62	0.64	0.65	0.63		SPXN : 0.022	0.065
Mean	0.55	0.59	0.58	0.58	0.58	0.57			
5 month after potting									
SP_1	0.57	0.58	0.56	0.52	0.54	0.56	6.6	Soil part: <0.001	0.050
SP_2	0.53	0.60	0.62	0.62	0.62	0.60		Nitrogen: 0.050	0.039
SP_3	0.60	0.67	0.66	0.66	0.70	0.66		SPXN : 0.099	0.077
Mean	0.57	0.62	0.62	0.60	0.62	0.60			
6 month after potting									
SP_1	0.59	0.62	0.59	0.56	0.58	0.59	1.1	Soil part: 0.002	0.064
SP_2	0.58	0.62	0.63	0.65	0.65	0.63		Nitrogen: 0.090	0.050
SP_3	0.61	0.69	0.68	0.69	0.75	0.68		SPXN : 0.406	0.099
Mean	0.59	0.64	0.63	0.64	0.66	0.63			

Collar Diameter Of Rootstocks

There was a significant difference on collar diameter of trifoliate rootstocks due to different ratio of potting mixtures (Table 2 and Fig 2). The largest collar diameter (0.68 cm) was observed due to treatment SP_2 (containing 2 part soil: 1 part FYM: 3 part sand) after 6 months of potting. While in 3, 4 and 5 months after potting it was found slightly larger in treatment SP_3 (containing 3 part soil: 2 part FYM: 1 part sand), whereas smallest diameter was observed in all months after planting in treatment SP_1 (containing 1 part soil: 3 part FYM: 2 part sand). The reason could be low water and nutrient holding capacity of potting mixture due to larger air space than water space.

There was no significant effect of nitrogen sprayed in the form of urea in the collar diameter of trifoliate rootstock. However, six months after potting collar diameter was slightly bigger (0. 66 cm) in treatment N_4 (3.5 gm urea spray at one month interval) than all other treatments.

The combined effect of nitrogen and potting mixtures also showed a non-significant difference in collar diameter of trifoliate rootstock in different months after potting. The effect of different potting mixtures and urea concentrations spray on collar diameter 6 months after potting is presented in Figure 2.

From this experiment it is clear that, nitrogen have greater role in increasing the height of rootstocks than collar diameter, where as potting mixtures have a significant role in increasing the collar diameter than plant height of the root stocks. Proper potting mixtures in combination with urea spray will be imperative in raising appropriate size of trifoliate rootstocks for budding and grafting purpose in optimum period of time.

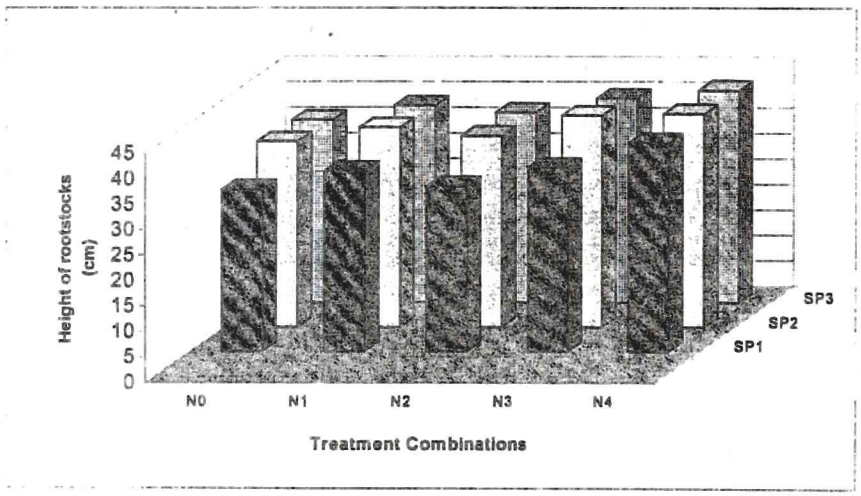

Figure 1: Effect of different potting mixtures and urea concentration on rootstocks height (cm) six months after potting

Note:

N_0 – Only water spray
N_1 – 0.5 gram urea/lit. water
N_2 – 1.5 gram urea/lit. water
N3 – 2.5 gram urea/lit. water
N_4 – 3.5 gram urea/lit. water

SP_1 – 1 part of soil: 3 part of FYM: 2 part sand
SP_2 – 2 part of soil: 1 part of FYM: 3 part sand and
SP_3 – 3 part of soil: 2 part of FYM: 1 part sand

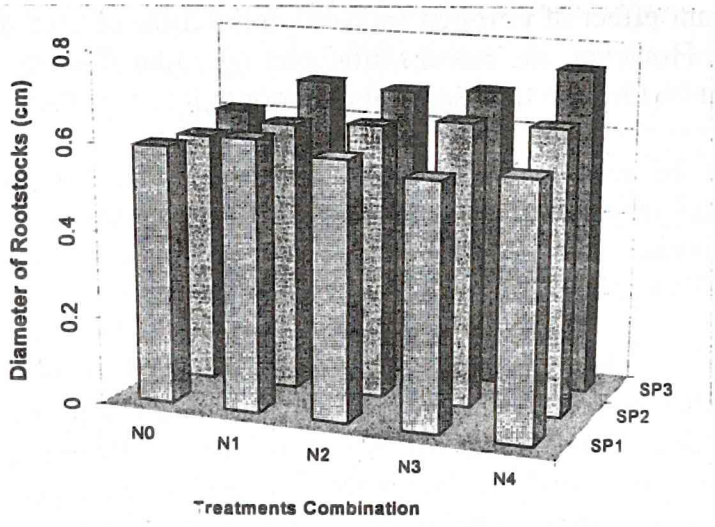

Figure 2: Effect of different potting mixtures and urea concentration spray on the collar diameter of trifoliate rootstock six months after potting

Note:

N_0 – Only water spray
N_1 – 0.5 gram urea/lit. water
N_2 – 1.5 gram urea/lit. water
N3 – 2.5 gram urea/lit. water
N_4 – 3.5 gram urea/lit. water

SP_1 – 1 part of soil: 3 part of FYM: 2 part sand
SP_2 – 2 part of soil: 1 part of FYM: 3 part sand and
SP_3 – 3 part of soil: 2 part of FYM: 1 part sand

ACKNOWLDGEMENT

Authors are grateful to the Hill Agriculture Research Project (HARP) for funding HARP-PP-103/98 Project. We would also like to thank Mr. K.B. Paudel, Horticulturist, for his support and encouragement in carrying out the experiment. We sincerely thank all the member of Horticulture Unit, ARS, Lumle, especially Messrs J.N. Chaudhary, Ramjee Paudel and K.P. Devkota for their tedious and hard work in trial implementation and data recording. Our special thanks go to Mr. Bhola S. Shrestha for his help in data analysis and Mr. Rishi R. Adhikari for word processing.

REFERENCES

APROSC and John Mellor Associates Inc.1995. Nepal Agriculture Perspective Plan. Agricultural Projects Services Centre, Kathmandu and John Mellor Associates Inc., Washington, D.C.

Ministry of Agriculture. 1997. Statistical information of Nepalese agriculture. Agricultural Statistics Division, Kathmandu, Nepal.

Shah, R.B.1992. Trainers' Manual No.16, Citrus fruit. Department of Agriculture Manpower Development Agriculture Project, Kathmandu, Nepal.

Shrestha, P.P. and S. K. Verma. (1994). Development and out look of citrus industry in Nepal. Proceeding of The National Horticulture Workshop, held on January,1998 at Kirtipur, Kathmandu, Nepal.

Subedi P.P., G.B. Gurung, and D.P. Lohar. 1994. Nursery methods, production constraints and storage of mandarin and variety screening of peach and chest nut. LAC Working Paper, No. 94/19.