Rooting of cutting and pads fragments of cactus pear

By Mohamed ARBA (1) and Hassan SBIHI (2)

(1) Plant Ecophysiology Laboratory, Institut Agronomique et Vétérinaire Hassan II, Complexe Horticole d'Agadir

(2) Domaine agricole PROCIT, Ouled Teima, Taroudant

INTRODUCTION

Cactus pear currently knows an important interest in several countries because of its ecological and socio-economic role. It's known by its resistance to drought regarding its particular cycle of photosynthesis CAM (Russel and Felker, 1987), and can be used in land utilization of marginal areas (Mizrahi et al., 1997). In Morocco, plantations of cactus pear are still traditional, and little is known on the aspects which are important in the cutting of cactus pear like as the number of pads per cutting, period and position of plantation of the cuttings and the use of pads fragments in the multiplication of cactus pear. The aim of this work was to contribute to the development of the techniques of multiplication of cactus pear by focusing of the techniques of rooting of the cuttings and pads fragments.

MATERIALS AND METHODS

Experiments were carried out in 2 tests: one on the rooting of simple cuttings (B1) (composed of one year-pads) and composed cuttings (composed of 2 pads (B2), 3 pads (B3) and 5 pads (B5)) (figure 1), and which are planted in different periods: autumn (P1), winter (P2) and spring (P3). Cuttings are taken on *Opuntia megacantha* Salm-Dyck in Biougra area. The experimental design was a complete randomized bloc and an experimental unit is a line with 8 cuttings; distance of plantation is 1m between lines and 0.5m between plants. The second test is on the rooting of fragments of one year cladodes of *Opuntia ficus indica* (L.) Mill.: basal fragment (FB), the medium one (FM) and upper fragment (FS), and which are planted in different positions: normal position (PN), reversed position (PR) and lateral position (PL) (figure 2). Plantation of fragments was done at the end of February and experiments were carried out in the experimental station of the IAV Hassan in Agadir. Observations were carried out one month after plantation and two months after, they were done on 4 cuttings/observation/experimental unit. Climatic data during the period of experiments are presented in table 1 and statistical analysis of data is done by ANOVA.

RESULTS

Since studied parameters are improved between the 1st and the 2nd observation, only results of the 2nd observation are discussed here.

1. Percentage of areols which emitted roots in regard to those which are in contact with soil (PAR): For the test of cuttings, PAR has increased for all the treatments. PAR of cuttings B1 and B2 is higher than that of B3 and B5, and PAR of cuttings which are planted in P1 and P3 is higher than that of those planted in P2. Except for interactions P2B2, P2B3 and P2B5, all other interactions have given a better performance (table 2). For the test of fragments, PAR has also increased for all the treatments. PAR of fragments FB and FS is higher than that of FM, and PAR of positions of plantation PN and PL is higher than that of PR. Best interactions were obtained with treatments FB-PN and FS-PR, and the lowest was obtained with FM-PR (table **3**).

2. Number of emitted roots by cutting (NR): For the test of cuttings, NR has increased for all the treatments. NR of B1 is higher than that of B2, B3 and B5, and NR of the period of plantation P1 is higher than that of P2 and P3. Best interactions were obtained with P1B1, P1B2, P1B3 and P2B1, and the lowest was with P2B5 and P3B3 (table 2). For the test of fragments, NR has also increased for all the treatments. NR of fragments FB and FS is higher than that of FM, and NR of positions of plantation PN and PL is higher than that of PR. Best interaction was obtained with FB-PN and the lowest with FM-PR (table 3).

3. Average length of emitted roots by cutting (LR): For the test of cuttings, LR has increased for all the treatments. It's relatively higher for B1 and B2 than for B3 and B5. It's also higher for P1 than for P2 and P3. Best interactions were obtained with P1B1 and P1B2, and the lowest was with P2B5, P3B3 and P3B2 (table 2). For the test of fragments, LR has also increased for all treatments. LR of fragments FB and FS is higher than that of FM and LR of positions of plantation PN and PL is higher than that of PR. Best interactions were obtained with FB-PN, FS-PN and FS-PL, and the lowest was with FM-PR (table 3).

DISCUSSION

For all the parameters studied and in both observations, cuttings which are planted in P1 have given a better rooting. Certain authors (Mulas, 1991) also showed that plantation of autumn has given a better rooting than that of winter and spring. This is due to dehydrated state of cuttings in autumn following the period of dry summer, what facilitates their rooting and the cicatrization of roots. Mulas (1991) also indicated that cuttings seem to root better when they are subjected to hydric stress conditions.

For the cuttings, those of 1 or 2 pads rooted better than those of 3 or 5 pads; that could be due to the basal pad which is older in the cuttings of 3 or 5 pads (often 3 years) than in those of 1 or of 2 pads (1 to 2 years). Several authors (Arba, 2009; Chahid, 1998; Chaussat and Bigot, 1980; Mulas, 1991; Mulas et al., 1992) showed that young pads or cuttings root better than the older ones.

For the fragments, studied parameters are improved. That is due to climatic conditions (rain in particular) which are favorable in March and April (table 1). The basal fragment rooted better than the others. Barbera et al., (1993) and Sbihi (2000) also showed that the basal fragment root better and that the potential of rooting is important in the basal areolas. Normal and lateral positions of plantation are the most powerful for rooting. That could be due to the important number of areolas which are in contact with soil and to normal position of plantation which is most suitable for the rooting of cuttings regarding the degree of polarity of cuttings (Chadli, 1988). Certain authors (Arba, 2009; Chahid, 1998) also showed that pads which are planted in normal position root better than those which are planted in flat or reversed position.

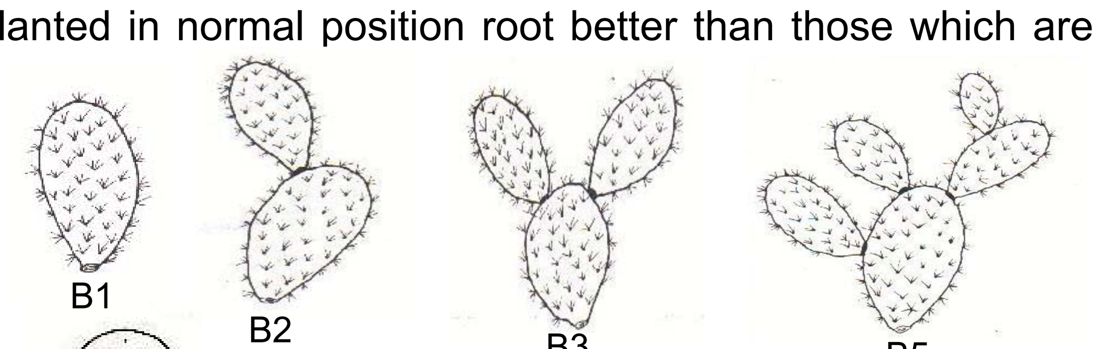

Figure 1: Simple (B1) and composed cuttings (B2, B3 and B5)

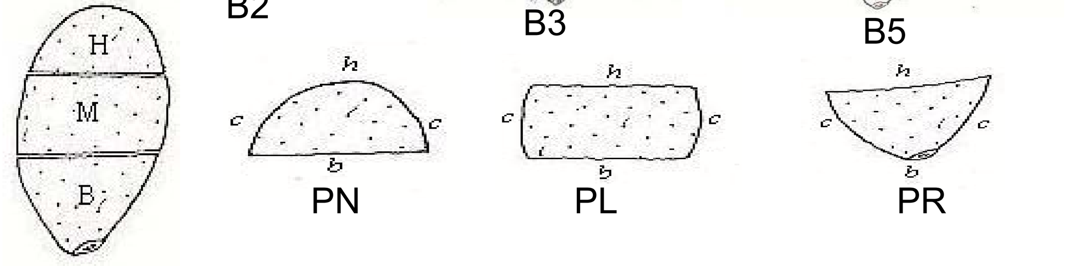

Figure 2: Pads fragments: B: basal (FB), M: medium (FM) and H: upper (FS), and position of plantation of fragment: normal (PN), lateral (PL) and reversed (PR)

CONCLUSION

For pads cutting, autumn period has given better rooting. These results are similar to those of Mulas (1991) who indicated that pads root better in autumn. Cuttings B1 and B2 root better than B3 and B. That is due to the basal pad which is older in B3 and B5 than in B1 and B2. These results are in conformity with those of several authors (Arba, 2009; Beakbane, 1969; Chahid, 1998; Chaussat and Bigot, 1980) who showed that young cladodes root better than the older. For the fragments, the rain in March and April involved an improvement of all the parameters . The basal fragment rooted better than the other fragments; that is in conformity with the results of certain authors (Barbera et al., 1993) who indicated that the basal fragment roots better than the others. Normal and lateral positions of plantation root better than the reversed one; that is due to the degree of polarity of pads and to the number of areols which are in contact with soil. These results are also in conformity with those of several authors (Arba, 2009 ; Chadli, 1988 ; Chahid, 1998) who showed that pads or cuttings which are planted in normal position root better than those which are planted in other positions.

REFERENCES

Arba, M. 2009: Rooting of one year and second year old cladodes of cactus pear. Acta Horticultureae, 811, 303-308.

Barbera, G; Carimi, F and Inglese, P 1993: Influenza dell epoca di impianto e del tipo di tallea sulla radicazione e sullo svillupo di barbatelle di Opuntia ficus indica Mill. Rivista di Frutticoltura, 10, 67-71.

Beakbane, A. B. 1969 : Relationships between structure and adventitious rooting. Proc. Inter. Plant Prop. Soc., 19, 192-201.

Chadli, F 1988 : Contribution à l'étude de l'aptitude à la regenèse des boutures de certaines plantes ornementales. Mémoire de fin d'études de 3ème cycle. IAV Hassan II, Complexe Horticole d'Agadir.

Chahid, E. H. 1998 : Implantation du cactus Opuntia : effet de l'âge, du positionnement des raquettes et de l'apport de l'eau sur l'enracinement des raquettes. Mémoire de 3ème cycle Horticulture. IAV Hassan II, Complexe Horticole d'Agadir.

Chaussat, R and Bigot, C 1980 : La multiplication végétative des plantes supérieures. Ed. Gauthier Villars, Paris, 51-72.

Mizrahi, Y.; Nerd, A. and Nobel, P. S. 1997: Cacti as crops. Horticultural Review, 18, 291-320.

Mulas, M. 1991 : Rooting experiments on one-year old cladodes of Opuntia ficus indica Mill. Irst International Symposium de Nopal y Tuna. Lagos de Morino, Jalisco-Mexico, 7p.

Mulas, M. ; Spano, D ; Pellizzari, G. and D'Hallewin, G. 1992: Rooting of Ountia ficus indica Mill. Young cladodes. Adv. Hort. Sci., 6, 44-46.

Russel, C. E. and Felker, P. 1987: The prickly pear (Opuntia spp.,Cactaceae): A source of human and animal food in arid and semi arid regions. Econ. Bot., 41, 433-445.

Table 1 : Climatic data of the medium of the experiments during the period of tests

	October	November	December	January	February	March	April	Mai	June	July
Temp. max (°C)	25,83	24,70	19,77	19,00	23,65	28,74	24,73	28,74	32,33	32,48
Temp. min (°C)	18,03	11,16	8,80	6,29	10,51	15,03	13,30	17,12	20,26	20,80
Average temp. (°C)	21,93	17,93	14,28	12,64	17,08	21,88	19,01	22,93	26,29	26,64
Precipitation (mm)	54,8	7,6	20,3	7,3	0	0	51,4	0	0	0

Table 2 : Percentage of areoles which emitted roots in regard to those which are in contact with soil (PAR), average number of emitted roots by cutting (NR) and average length of emitted roots by cutting (LR) for the periods of plantation of autumn (P1), winter (P2) and spring (P3)

	% of areols which emitted roots/those which are in contact with soil (PAR)		Number of emitted roots/cutting (NR)		Length of emitted roots/cutting (LR) (cm)	
treatments	0bservation 1	Obs. 2	0bs. 1	Obs. 2	0bs. 1	Obs. 2
Period of plantation						
P1	50,96	57,39	18,33	27,39	2,34	11,89
P2	15,08	30,68	4,97	12,17	0,52	2,81
P3	28,32	53,10	10,64	18,90	2,23	5,27
Level of signification	***	***	***	***	***	***
Type of cutting						
B1	36,8	55,05	14,36	23,45	2,28	8,88
B2	33,12	51,18	12,02	19,48	1,84	8,01
B3	21,72	41,35	9,14	17,15	2,02	6,41
B5	23,32	42,19	8,66	16,73	1,41	6,26
Level of signifiance	***	***	*	***	NS	***
Interaction period of plantation-type of cutting						
P1-B1	62,24	65,76	20,25	25,13	3,80	14,09
P1-B2	64,16	71,24	22,71	26,81	2,12	14,88
P1-B3	24,46	40,86	13,19	29,30	1,88	10,74
P1-B5	30,83	41,26	17,19	28,31	1,56	7,86
P2-B1	25,76	41,08	6,50	17,29	0,34	2,98
P2-B2	10,24	33,76	2,63	12	0,28	3,17
P2-B3	9,83	17,69	5,94	11,31	1,40	2,85
P2-B5	7,51	16,60	4,81	8,06	0,06	2,25
P3-B1	35,84	56,76	14,13	22,38	3,35	5,99
P3-B2	31,24	59,68	10,63	19,17	3,35	4,28
P3-B3	16,43	30,71	10,19	14,38	3,10	4,25
P3-B5	16,60	38,00	7,63	19,70	3,14	6,55
Level of signifiance	NS	NS	NS	**	NS	*

Table 3 : Percentage of areoles which emitted roots in regard to those which are in contact with soil (PAR), average number of emitted roots by fragment (NR) and average length of emitted roots by fragment (LR) for normal position of plantation (PN), lateral position (PL) and reversed position (PR)

	% of areols which emitted roots/those which are in contact with soil (PAR)		Number of emitted roots by fragment (NR)		Length of emitted roots by fragment (LR) (cm)	
treatements	0bservation 1	Obs. 2	0bs. 1	Obs. 2	0bs. 1	Obs. 2
Type of fragment						
FB	27,46	65,04	3,48	9,24	2,31	7,60
FM	14,42	34,39	1,17	4,25	1,43	4,90
FS	28,71	73,62	3,06	9,67	2,15	8,33
Level of signifiance	***	**	***	**	**	**
Position of plantation of fragment						
PN	25,50	63,42	3,23	10,33	2,19	7,53
PL	28,88	67,65	2,98	8,52	2,31	7,61
PR	15,88	42,28	1,50	5,00	1,39	5,76
Level of signifiance	***	NS	***	**	**	NS
Interaction fragment-position of plantation						
FB-PN	40,11	98,24	6,06	17,44	2,76	7,84
FB-PL	37,08	76,14	3,69	9,06	2,51	7,39
FB-PR	8,56	23,21	0,69	3,31	1,65	7,57
FM-PN	20,42	43,19	1,69	5,88	1,56	6,03
FM-PL	18,31	57,15	1,25	6,38	2,10	6,43
FM-PR	7,06	6,43	0,56	0,50	0,63	2,49
FS-PN	19,42	50,13	1,94	7,69	2,23	8,73
FS-PL	39,23	77,17	4,00	10,13	2,31	9,03
FS-PR	38,51	97,72	3,25	11,19	1,90	7,22
Level of signifiance	***	**	***	**	NS	NS