

Five Years Performance of New Introduced Salt Tolerant Hybrid Poplar clones (Mofid and *P. × albaeuphratica*) In Iran (West Azar-Bayjan)

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Summary

In order to introduce new hybrids poplar clones ("Mofide" and *P. × albaeuphratica*) for commercial wood production in different part of country, ecological range of productivity have to be determined. Therefore, adaptability of two hybrid clones "Mofide" and its reciprocal crosses hybrid (*P. × albaeuphratica*), along with *Populus alba* L. as local clone (Kaboodeh) were tested in Rasol Abad Salty-soil Research station during 2004–2009. The experiment was conducted through randomized complete block design (RCBD). Twenty five individual cuttings of three clones (two hybrids and one local clone) planted in 100 square m as an experimental plot at spacing (2 × 2 m distance) and replicated three. Analyses of collected data have been done based on quantities and qualitative characters during five years. The results indicated that there were highly significant differences between clones at the 0.01 level. *Populus euphratica* Oliv. × *P. alba* L. hybrid (Mofid) showed highest diameter at breast height (11.30 cm), and total height (10 m) than the others two. Low level of breast diameter height (4.15 cm) and total height (5.5 m) were observed for *Populus alba* L. (Kaboodeh) clone as a local poplar clone.

Key Words: Hybrid poplar, Inter specific hybrid, *Populus euphratica* Oliv. × *P. alba* L., *Populus alba* L. × *P. euphratica* Oliv.

Introduction

Iran belongs to low forest coverage countries (LFCC). Total forest area in Iran is estimated 12.4 million hectares but only 1.2 million

hectares can be considered as commercial forest. In spite of such a situation, forest in Iran is being damaged by many factors (BAGHERI, 1996). Annually wood production through poplar is being estimated 1.5 million m³. The wood production of poplars is higher than wood which are produced by forest.

Poplar produce 1.5 million m³ wood while the wood which are produced by forests and other wood production sources are estimated 730.000 m³ (JALLILI, 2009). Therefore wood production through fast growing trees especially poplars, became an urgent task of our government. Among poplar species, *Populus euphratica* Oliv. has been showed, varying degrees of tolerance to the salinity, periodic water longing, cold and arid conditions (KALAGRY *et al.*, 2000; WIART, 1988). Unfortunately, overuse has removed many of the stems of better form, so that natural stands now usually appear small and crooked (JAFARI MOFIDABADI *et al.*, 1998). Numerous attempts have been done to improve such a high value species, using inter-specific hybridization between *Populus euphratica* Oliv. × *P. alba* L. (JAFARI MOFIDABADI *et al.*, 1998; JAFARI MOFIDABADI and MODIR-RAHMATI, 2000; LI *et al.*, 1983; LI and LI, 1985). Hybridization is currently used to combine desirable traits and to achieve hybrid vigor in many crops and trees (TABAI-AGHDAAI and JAFARI MOFIDABADI, 2000, PRYOR and WILLING, 1983). There has been a long interest in the hybridization of poplar largely because of the benefits derived from capturing heterosis and combining desirable traits to improve the quality and amount of wood production (JAFARI MOFIDABADI *et al.*, 1998). In view of its resistance to drought and salinity, *Populus euphratica* Oliv. has been chosen as a parental species in poplar breeding. Incompatibility which have been observed between this species with other poplars species have been solved by *In vitro*

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embryo culture (LI *et al.*, 1983). Inter-specific hybrids between *Populus euphratica* Oliv. and *P. alba* L. have been produced into direction in Iran (JAFARI MOFIDABADI *et al.*, 1998; (JAFARI MOFIDABADI and MODIR-RHMATI, 2000). Introduction of new hybrid poplar is a routine work in Iran. Due to various reaction of plants in different climate conditions and its economical products, test of adaptability is an urgent task of breeder particularly for introduction of new hybrid in a given areas. Adaptability of poplar trees to different climate conditions depends on the genetic potential and its interaction with environment factors (KALAGARY, 1998; YU and PULKKIN, 2003). In order to introduce new poplar hybrids (*Populus euphratica* Oliv. \times *P. alba* L. and *Populus alba* L. \times *P. euphratica* Oliv.) in different part of country for poplar wood production particularly in saline soil, ecological ranges for economically wood production have to be determined. Therefore test of adaptability and economically wood production of Mofid (*Populus euphratica* Oliv. \times *P. alba* L.) and its reciprocal crosses (*P. \times albaeuphratica*) were studied in Rasol-Abad Salty-soil Research station of Central Research of Agriculture and Natural Resources of West Azar-Bayjan (2004–2009).

Materials and Methods

Two hundred twenty five potted one year stem cutting of three poplars clones including two hybrid (*P. \times albaeuphratica*, and Mofid) and one *Populus alba* L. (Kaboodeh) as a local clones were planted in Salty-soil Rasol abad Research station belonging to Research Center of Agriculture and Natural Resources of West Azerbaijan province during years of 2004–2009. The experiment was conducted based on Complete Randomized Block Design (RCBD) with 3 replications. Seventy five potted stem cutting were planted in three rows with 250 cm row-spacing and 200 cm space between cuttings as an experimental unit (Table 1). All the recom-

mended cultivation practices such as weeding, fertilizers and irrigation were done properly at the required time. Analysis of variance and comparison of means of collected dates were carried out for total height diameter at breast height trunk height, cold and pest resistance.

Results and Discussion

There were highly significant differences between clones for height and for diameter breast height (dbh) at $\alpha=0.01$ level (Table 2 and Fig. 1). Highest growth was observed for Mofid hybrid poplar (average 5.85 and maximum 10 m) while Kaboodeh (*Populus alba* L.) with average 2.95 m (maximum 5.5 m) showed lowest level of height growth (Table 3 and Fig. 1). Highest diameter at breast height was observed for Mofid (11.30 cm) while lowest level of diameters at breast height (4.1 cm) occurred for Kaboodeh (Table 3).

No significant differences were observed between *P. \times albaeuphratica* and Mofid (*Populus euphratica* Oliv. \times *P. alba* L.) hybrids clones. Mofid hybrid poplar clone with 10 meter height and 11.30 hcentimeter diameter breast height showed its superiority to the *Populus alba* L. clone as a local tree (Table 3).

There were significant differences between clones for survival rate at $\alpha=0.05$ level in the end of five years experiment (Table 2 and Fig. 1). Mofid hybrid poplar clone showed highest survival rate (97.5%) while lowest level of survival (84%) was observed for Kaboodeh local clone (Table 3 and Fig. 1). Low productivity of most native poplar clones caused decreasing poplar cultivation area. Therefore use of hybrid poplar is necessary to increase wood production in many part of the country (IRAN-MENESH, 2008). Inter and intra-specific hybridization and selection of superior hybrid progeny have been caused successfully introduction of hybrid clones in country (JAFARI MOFIDABADI *et al.*, 1998). For introduction of a new hybrid poplar

Table 1. – Origen, name and number of clones applied in this experiment.

Origen of clone	Name of clones	Number of trees/plot	Replication	Total number of each clone
<i>Populus euphratica</i> Oliv. \times <i>P. alba</i> L.	“Mofid”	25*	3	75
<i>Populus alba</i> L. \times <i>P. euphratica</i> Oliv.	<i>P. \times albaeuphratica</i>	25	3	75
<i>Populus alba</i> L.	Kaboodeh (local clone)	25	3	75

* 25 = Five rows with 5 tree in each row.

Table 2. – Analysis of collected dates for adaptability of three poplars clones.

Source of variation	Df	MS		
		Height	Dbh	Survival rate
Clones	2	119358**	48.31**	1353*
Error	29	9594	1.76	253.9
Total	8			

** = significant differences at 0.01 level.

* = significant differences at 0.05 level.

Table 3. – Mean comparison of different characters of three poplar clones.

Clones	No	Height (m)		Dbh (cm)		Survival rate (%)
		Mean	Maximum	Mean	Maximum	
Mofid	75	5.85 a	10	5.98a	11.30	97.5a
<i>P. × albaeuphratica</i>	75	5.67a	9.35	5.75a	10	87a
Kaboodeh	75	2.95b	5.5	2.45b	4.15	84b

The same letters indicated no significant different at $\alpha = 0.01$ level.

clones, superiority of hybrid against native clones have to be proved (ASAREH, 2009). Narrow and broad senses adaptability trail of Mofid and *P. × albaeuphratica* as its reciprocal crosses have been conducted through country for maximum use of heterotic effect in wood production (GHEMERI-ZAREH, 2008). IRAN-MANESH (2006) reported heterotic effect for total height and breast height diameter of hybrid poplar clones (Mofid and *P. × albaeuphratica*) and their superiority to the local clone Kaboodeh (*Populus alba* L.). In contrast to the

Charmehal-Bakhtiari province, which the *P. × albaeuphratica* hybrid clone showed superiority in trunk height and breast height diameter to Mofid hybrid clone (GHEMERI-ZAREH, 2008), higher performance was observed for Mofid in West Azar-Bayjan. In another research which was conducted by TALEBI *et al.* (2008), the results indicated that Kaboodeh (*Populus alba* L.) with high performance was the best among other different poplar clones in a five years old adaptability trail. Therefore these superior clone was used for commercial wood production in Charmehal-Bakhtiari province (TALEBI *et al.*, 2008). In a cold resistance experiment for poplars clones which were conducted by IRAN-MENESH (2006) in Charmehal-Bakhtiari province indicated that only Mofid hybrid clone and *Populus euphratica* Oliv. are sensitive to winter and spring cold condition (below minus 30°C). This was due to low level cold tolerance of *P. euphratica* Oliv. as a maternal parent in *Populus euphratica* Oliv. × *P. alba* L. hybrids. Terminal bud damage caused branching in upper part of *Populus euphratica* Oliv. × *P. alba* L. tree in next growing season at Chatmehale-Bkhtiyari (IRAN-MENESH, 2008), While *Populus alba* L. × *P. euphratica* Oliv. showed a high level of cold tolerance and had not been effected in minus 30°C. This caused due to cold tolerance of Kaboodeh (*Populus alba* L.) as maternal parent in *Populus alba* L. × *P. euphratica* Oliv. Due to cold susceptibility of Mofid hybrid poplar clone, it was not suggested for wood cultivation program in the Charmehal-Bakhtiari province. In spite of cold susceptibil-

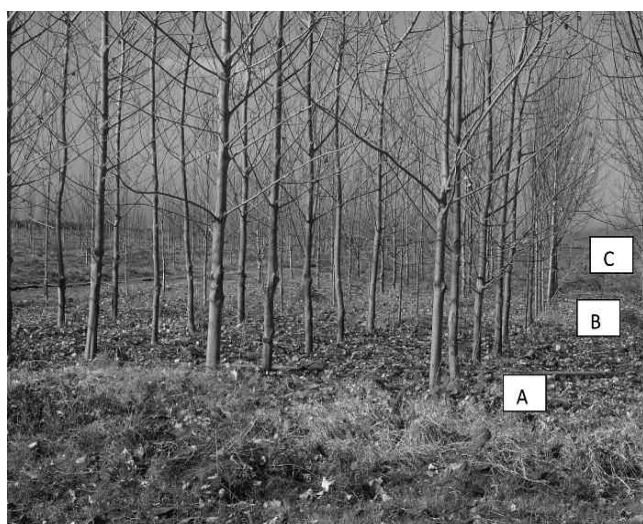


Figure 1. – A: Five year performance of Mofid, *P. × albaeuphratica* and Kaboodeh in Rasol-Abad salty-soil Research Station belong to Central Research of Agriculture and Natural Resources – West Azar-Bayjan Province – (A = Mofid, B = Kaboodeh, C = *P. × albaeuphratica*).

ity of Mofid hybrid poplar clones, this kind of hybrid showed higher resistance than the other three against *Melanophila picta* Pall (TALEBI *et al.*, 2008 and GHEMERI-ZAREH, 2008). This is may be due to high resistance of *Populus euphratica* Oliv. as a maternal parent of Mofid hybrid poplar clone (*Populus euphratica* Oliv. × *P. alba* L.). In contrast to the Charmehal-Bakhtiari province which cold condition (below minus 30°C) caused damage for Mofid hybrid poplar clones (IRAN-MANESH, 2006), no cold effect were observed for this clone in West Azar-Bayjan.

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