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NOTE

USE OF LOCAL MATERIAL IN SEED-BED MIXES FOR PRODUCTION OF SEEDLING FROM TRUE POTATO SEED[1]

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ABSTRACT

In 1984, twenty three treatments resulting from a factorial combination of two methods of sowing i.e. in 100 ml plastic pots and in flats, with 9 soil mixes consisting of different proportions of decomposed manure, sand and soil and a control (peat moss and sand) were compared. The 20-40-40, 40-30-30, and 60-40-0 mixes resulted in a good emergence, seedling vigor, rate of survival and yield. These mixes were tried in another experiment with the same sowing methods in Isfahan and Fereydan in 1985. For Isfahan soil mixes of 60-20-20 and 40-30-30, preferably in pots and for Fereydan the same mixes in either pots or flats can be recommended.

تحقیقات کشاورزی ایران

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استفاده از مواد محلی در مخلوط بستر بذر حقیقی سیب زمینی جهت تولید نشاء

علیرضا سپاهی و احمد مرتضوی بیک

به ترتیب استادیار اصلاح نباتات گروه زیست شناسی دانشگاه اصفهان و دانشجوی فوق لیسانس دانشکده کشاورزی دانشگاه صنعتی اصفهان .

خلاصه

درسال ۱۳۶۳ ،بیست تیمار حاصل از ترکیب فاکتوریل دوروش کاشت شامل کاشت درگلدان‌های پلاستیکی یکصد میلی لیتری ودرجعبه ونه مخلوط کاشت مرکب از نسبت های مختلف کـــــود پوسیده ،ماسه وخاک ویک شاهد (پیت خزه وماسه)موردمقایسه قرار گرفت.مخلوط های۲۰-۴۰-۴۰،

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1. Contribution from the Potato Research Project of Isfahan University, Isfahan, Iran, and a part of the M.S. thesis of the second author.

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۴۰-۳۰-۳۰، ۶۰-۴۰-۰، منجربه جوانه زدن بهتر، رشد بیشتر گیاهچه ها، درصد بقاء وعملکرد بالاتر گردید. از این مخلوط ها و با همان دوروش کاشت در یک آزمایش دیگر در اصفهان وفریدن درسال ۱۳۶۵ استفاده گردید. با توجه به نتایج حاصله، برای اصفهان مخلوط های ۶۰،۲۰،۲۰ و ۴۰،۳۰،۳۰ ترجیحا در گلدان وبرای فریدن دومخلوط فوق درجعبه یا در گلدان قابل توصیه است.

INTRODUCTION

Seed tubers represent 40-70% of the potato production cost (1); moreover, in the developing countries seed tubers frequently need to be imported (6). Many important potato diseases such as late blight, bacterial wilt and some 50 viruses are transmitted through tubers (6). Only 100 grams of true potato seed (TPS) is used instead of two tons of seed tubers to plant one hectare (1). Moreover, of the four viruses and one viroid known to be transmitted through TPS only the viroid PSTV could be a problem (6). The potential use of TPS as an alternative to using seed tubers has recently received attention. About 36 developing countries are undertaking TPS research (2). In Iran, however, no work on TPS has been reported previously. Transplanting seedlings is one of the common methods of using TPS. It may be successful, especially in vegetable growing areas, where farmers are experienced in handling seedlings (4, 5). One of the most important factors in the production of TPS seedlings is the kind of seed-bed mix used. The recommended mixture (1) is one part peat moss and one part sand with some fertilizers added. Peat moss is not easily available in developing countries, thus research on the use of locally available material has been advocated (1, 3). Farm yard manure is readily available in Iran. Mal-effects due to the use of fresh (3) and high salt content (7) manure have been reported. This work was carried out to find a suitable seed-bed mix consisting of decomposed manure, soil and sand.

MATERIALS AND METHODS

Experiment I

Twenty treatments resulting from a factorial combination of two methods of sowing, namely in 100 ml plastic pots and in flats, 5 cm deep, with ten different soil mixes were compared in Isfahan in 1984. The ten mixes consisted of a control i.e. 50% peat moss and 50% sand with the addition of the recommended fertilizers (1) and nine combinations of soil, decomposed manure and sand in the proportions in dicated in Table 2. No fertilizer was added to the nine mixes. Seeds of Atzimba x R-128.6 were sown, five per hole, in the greenhouse on March 20. In flats the holes were 6 cm apart. The day and night temperatures were set at around 20°C and 15°C, respectively. The seedlings of all the ten mixes were fertilized with the recommended solution (1). Percent emergence two weeks after sowing and at transplanting was determined. The seedlings were transplanted in the field on May 7, after one week of hardening in the open. A visual rating on the vigor was given to the seedlings prior to transplanting. The treatments were allocated to 10-hill-single row plots according to a complete randomized block design with three replications. At harvest (Sept. 6), percent survival, yield per hill and per m^2 were determined.

Experiment II

Ten treatments from a factorial combination of the two methods of sowing and five different soil mixes were compared in Isfahan and Fereydan in 1985. Soil texture and mean monthly temperatures for the two locations are presented in Table 1. The five mixes consisted of a control (i.e., peat moss and sand) and four mixes as indicated in Tables 3 and 4. The seeds of R-128.6 were sown in the greenhouse on March 18 and March 31, and were transplanted in Isfahan on April 20 and in Fereydan on May 12, respectively. Percent emergence two weeks after sowing was noted. Dry weight of samples of

Table 1. Mechanical analysis and mean monthly temperature for Isfahan and Fereydan in 1985.

	Mechanical analysis			Mean monthly temperature °C					
	% clay	% silt	% sand	April	May	June	July	August	September
Isfahan	35	46	19	16.3	20.2	26.6	28.7	25.0	23.8
Fereydan	29	34	37	-	13.8	20.0	22.4	19.6	16.5

seedlings from different treatments were determined prior to transplanting. A complete randomized design with four replications was used. During the growing season, diameter (D) and height (H) of 25 of the hills in the border rows were measured. The haulms were then cut off, dried and weighed. Their volumes were estimated by

$$V = [\frac{4}{3}\pi H(\frac{D}{2})2]\ 12,$$

which can be reduced to V = 0.52HD. Regression of haulm dry weight (W) on volume was calculated and used to estimate the weight of individual hills (seven times in Isfahan and 10 times in Fereydan) throughout the growing season. At harvest, Aug. 8 for Isfahan and Sept. 3 for Fereydan, measurements were taken on percent survival, yield per hill and per m^2, number of tubers per plant and average weight of tubers.

RESULTS AND DISCUSSION

Experiment I

The analyses of variance showed no significant effect due to sowing methods for any of the characteristics measured. There was also no interaction between sowing method and seed-bed mix. Means for the characteristics for the levels of the two factors are presented in Table 2. The results indicate a decrease in percent emergence (on the hill basis) due to the use of manure in the seed-bed at the rate of 80%, an effect also indicated by others (3, 7). Single degree freedom comparisons were made between treatments containing more than 30% sand and others (except the control); and those lacking manure and others (except the control). Elimination of manure from the mix and addition of sand to the mix at the rate of more than 30% decreased (significant at 1% level) the percent survival in the field. The two effects are confounded, however, and no definite statement can be made in

Table 2. Means[†] for characteristics measured for sowing methods and seed bed mixes, in Isfahan in 1984.

Treatment factor			% emergence		Seedling[‡] vigor	Percent survival	Yield hill^{-1}(g)	Yield m^{-2} (kg)
			two weeks after sowing	at trans-planting				
Sowing method								
Pots			53	96	3.1	79	157	0.52
Flats			53	94	2.3	78	162	0.53
Seed bed mix								
% Soil	% Manure	% Sand						
20	0	80	10	99	4.5	67c	106ef	0.29f
20	40	40	70	62	1.5	75bc	183bc	0.57cd
20	80	40	12	100	4.0	85ab	93f	0.32f
40	0	60	50	100	3.5	70c	129def	0.37ef
40	30	30	80	90	1.5	82bc	260a	0.87f
40	60	0	40	100	2.5	80bc	140cde	0.46de
60	0	40	40	100	4.5	71c	146cde	0.43e
60	20	20	70	99	1.5	81bc	172bcd	0.58c
60	40	0	65	100	1.5	82bc	165bcd	0.56cd
Control (peat moss and sand)			95	91	1.5	92a	203b	0.77b

[†]Mean comparisons are done at 5% level using Student Newman Keuls' test.

[‡]By rating from 1-5, 1 being most vigorous.

this respect. Of the nine mixes, 20-40-40, 40-30-30, 60-40-0 and 60-20-20 resulted in the highest yields per hill and per m^2 with relatively good emergence, seedling vigor and rate of survival.

Experiment II

Regarding the sowing methods, sowing in pots resulted in better survival in Isfahan (Table 3), whereas in Fereydan (Table 4), sowing in flats was superior. This could be due to less root disturbance in pots which is beneficial in the relatively warm and dry climate of Isfahan. Under the cool conditions of Fereydan, however, the amount of roots (which was more in flats) rather than its degree of disturbance resulted in better survival. As to the seed-bed mixes, in Isfahan (Table 3), 40-30-30 resulted in good seedling vigor (represented by dry weight), a high percent survival and higher yield per plant and per m^2 than other mixes except the control. In Fereydan (Table 4), both 40-30-30 and 60-20-20 mixes showed good results regarding seedling vigor, percent survival, yield per plant and per m^2. It seems that addition of manure at the rate of 40% resulted in a decrease in percent survival in both locations (Tables 3 and 4). Addition of sand caused an increase in the number of tubers at both locations (Tables 3 and 4).

Regarding the rate of growth, different regression coefficients were compared by a t-test. At Fereydan, there was no significant difference between pot and flat method of sowing. The only significant differences at this location were those between control and the 60-40-0 and 20-40-40 mixes (Fig. 1b). In Isfahan the rate of growth of the pot method of sowing was significantly higher than that of the flat (Fig. 1c). With respect to mixes, except for 60-20-20 and 40-30-30 which were not significantly different, all other comparisons showed significant differences. The rate of growth was closely related to yield per hill (Tables 3 and 4).

Table 3. Means[†] for characteristics measured, along with the equations for regression of growth on time for sowing methods and seed bed mixes in Isfahan in 1985.

			Emergence two weeks after sowing (%)	Seedling dry wt[‡] (g)	Percent survival	Yield hill^{-1} (g)	Yield m^{-2} (kg)	No. of tubers hill^{-1}	Average of tubers (g)	Regression equation of growth on time
Sowing method										
Pots			43	0.9	61a	220	0.57a	4.7	47a	w=29.6 + 1.37D r=0.98**
Flats			38	0.8	48a	212	0.44b	4.8	44b	w= -20.8+1.02D r=0.98**
Seed bed mix										
% Soil	% Manure	% Sand								
60	40	0	21	0.4	46b	155c	0.28d	3.6c	43cd	w= -14.9+0.68D r=0.98**
60	20	20	50	0.8	60a	210b	0.53c	4.7b	45bc	w=26.8 + 1.28D r=0.98**
40	30	30	49	1.7	62a	247b	0.64b	5.2ab	47b	w= -25.6+1.24D r=0.98**
20	40	40	20	0.7	40b	171c	0.28d	4.3b	40d	w= -22.9+0.97D r=0.98**
Control (peat moss and sand)			64	1.5	65a	297a	0.81a	5.7a	52a	w= -35.9+1.80D r= 0.97**

[†]Mean comparisons are done at 5% level using the Student Newman Keuls' test.

[‡]Seedling dry wt measured at the end of the greenhouse period, prior to planting in the field.

**Significant at 1% level.

Table 4. Means[†] for characteristics measured, along with the equations for regression of growth on time for sowing methods and seed bed mixes in Fereydan in 1985.

Treatment factor			Seedling dry wt[‡] (g)	Percent survival	Yield hill^{-1}(g)	Yield m^{-2}(kg)	No. of tubers hill^{-1}	Average wt of tubers (g)	Regression equation of growth on time
Sowing method									
Pots			1.7	68b	457	1.27	7.4	62	w= -34.7 + 1.34D r=0.92**
Flats			1.9	74a	457	1.35	7.0	64	w= -26.9 + 1.09D r=0.92**
Seed bed mix									
% Soil	% Manure	% Sand							
60	40	0	0.9	64c	306b	0.80c	5.6b	55	w= -23.2 + 0.91D r=0.92**
60	20	20	1.9	88a	403ab	1.49b	6.2b	65	w= -30.5 + 1.18D r=0.92**
40	30	30	1.9	82b	427ab	1.45b	6.5b	65	w= -34.3 + 1.34D r=0.92**
20	40	40	1.6	45d	550ab	0.95c	8.5a	64	w= -22.5 + 0.86 r=0.91**
Control (peat moss and sand)			2.5	75b	596a	1.85a	9.0a	66	w= -43.7 + 1.78D r=0.90**

[†]Mean comparisons are done at 5% level using Student Newman Keuls' test.

[‡]Seedling dry wt measured at the end of the greenhouse period, prior to planting in the field.

**Significant at 1% level.

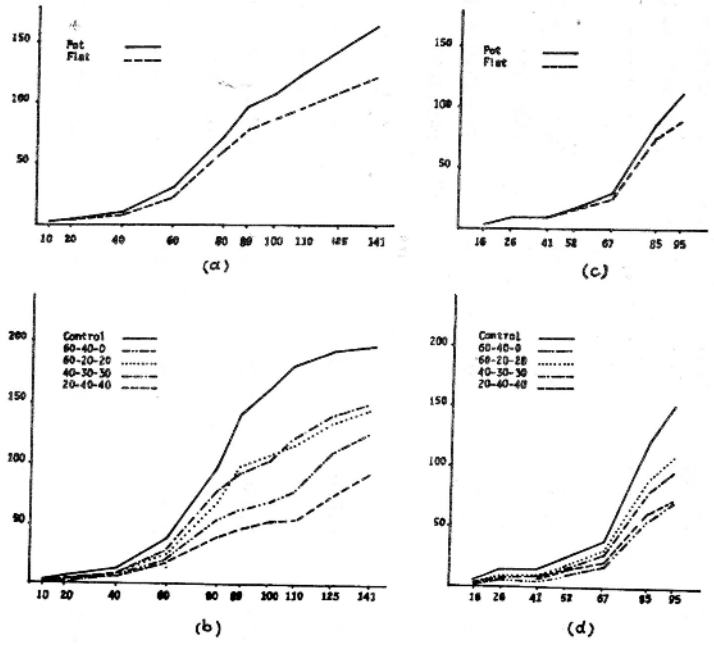

Fig. 1. Estimated haulm dry weight in grams (ordinate) depicted against days from transplanting (abscissa) for different treatments in Fereydan (a and b) and in Isfahan (c and d).

CONCLUSION

For Isfahan soil mixes of 60-20-20 and 40-30-30, preferably in pots and for Fereydan the same mixes in either pots or flats can be recommended. In general yields were lower (about 1/2 in Fereydan and 1/4 in Isfahan) than those of the conventional potato production in the two areas. Lower yields in Isfahan is mainly due to late planting to avoid a late spring frost common in the area and the advent of warm weather right after. More work is needed on the choice of suitable cultivars and cultural methods.

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