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PERFORMANCE OF POTATO VARIETIES RAISED FROM TRUE POTATO SEED IN JOS PLATEAU, NIGERIA.

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ABSTRACT

Seedlings of true potato seeds from seven cultivars (RC 767-2, Br. 63-18, Kondor, VC 785-2 Raslin Ruaka, VC 801-4 and CIP 387705-18), and seed tubers from Nicola variety were evaluated for tuber yield and resistance to pests and diseases at Kuru, Jos Plateau. The trials were carried out in the 1997 and 1998 rainy seasons. The result showed that average seed germination was 81.1% for the TPS genotypes, with CIP 387705-18, Kondor and RC 767-2 performing best in decreasing order. Field establishment was 96.4% for Nicola, 85.3% for Br. 63-18 and 51.4% for VC 785-2. Diseases and pests attacks were low in all the potato genotypes, but for Kondor with high bacterial wilt. Tuber yield and % ware tubers were higher in Nicola than in other TPS genotypes. Tuber yield of RC 767-2 and % ware tubers were better than in other genotypes established from true potato seed. Nicola had 100% uniformity in tuber shape and skin colour. Only RC 767-2 and CIP 387705-18 had 100% uniformity in skin colour. The study showed that it is possible to produce healthy seed tubers from true potato seed under Jos Plateau, Nigeria conditions. Among the TPS genotypes studied CIP 387705-18 and RC 767-2 are recommended because of their uniformity in skin colour, low disease and pest attacks, high tuber yield with high percentage of large size tubers.

INTRODUCTION

The traditional method of propagating potato (Solanum tuberosum L.) is by the use of seed tubers (Bryan et al., 1981). Multiplication rate of seed tubers is however low (1:7) and several seasons of multiplication is required to produce the quantity of seed needed by potato farmers in Nigeria. In the process of prolonged multiplication the quality of seed may be lost due to seed degeneration and disease infection (Bryan et al., 1981). In 1991, seed demand by potato farmers in Nigeria was estimated at 80,000 tonnes (Okonkwo et al., 1995), and farmers produced only about 30% of that requirement. Seed tubers constitute about 45% of the total cost of producing potato in Nigeria (Okonkwo et al., 1995). Consequently, only wealthy farmers can own large farms of potato.

True potato seed is presently used for seed and ware tuber production in countries like China, India, Peru and Rwanda (Malagamba and Monares,

1988 and Hardy et al., 1994). Only 150g of viable true potato seed (TPS) is required to plant one hectare of land as against 2.5 tonnes of seed tubers (Malagamba and Monares, 1988; Burton, 1989). In addition to the reduction in production costs, successful use of TPS for potato production will be a break-through, especially in the low altitude northern areas of Nigeria where high seed storage and transportation costs hinder the expansion of potato production. Baker and Johnson (1980) found that true seed would give up to 60% germination after 15 years of storage, but under tropical conditions seed tuber cannot be stored for more than 7 months without refrigeration (Okonkwo et al., 1995) Also tuber borne diseases such as bacterial wilt (Pseudomanas solanaceorum) virus x, y and leaf roll can be reduced by the use of this method for potato production (Burton, 1989). The use of TPS for potato production will increase seed tubers and release more tubers for consumption.

Studies in Jos Plateau, Nigeria showed that TPS can be produced from about 34 potato cultivars presently grown in Nigeria. Also seed tubers have been successfully produced from the botanical seed under Jos Plateau, Nigeria conditions (Okonkwo and Amadi, 1995). This study evaluated the field performance of TPS produced from open pollinated potato cultivars under Jos Plateau conditions.

MATERIALS AND METHODS

This study was carried out during the 1997 and 1998 rainy seasons at Kuru, Jos Plateau (1350m above sea level) and located at latitude 9.8° N and longitude 8.7° E. The soil is ferrallitic cambisol developed from Volcanic rocks (Enwezor et al. 1990). The soil nutrient content and weather data of the experimental site are shown on Table 1 and 2.

True potato seedling from RC 767-2, Kondor, Br. 63-18, Roslin Ruaka, VC 785-2, VC 801-4 and CIP 387705-18 were raised in nursery seed beds measuring 1m x 2m. The top 5cm of the seedbed was filled with germination media consisting of 3 river sand + 3 parts cowdung + 1 part top soil + 10 g single superphosphate per kg of the media mixture. Seed germination test was carried out under laboratory conditions to determine the viability of the TPS seeds before seedlings were raised in the nursery. The germination media mixture was steam sterilized to destroy weed seed and pathogenic microorganisms. Seed was drilled 2 cm deep in rows spaced 10 cm apart. Shade was provided over the seedbed to protect the germinating seeds from direct raindrops and sunlight, and also to cool the soil. The shade was thinned down when seedlings emerged and finally removed about 2 weeks after seedling emergence. The nursery was watered daily until seedlings emerged, then watering was reduced to once in 2 days, except when it rained. Seedlings were transplanted 6 weeks after they emerged on wet soils. Fertilizers were split applied at 2 and 4 weeks after transplanting at the rate of 100kg N and P_2O_5/ha and 40kg K_2O/ha. Weeding was done manually at 4 and 8 weeks after transplanting. During weeding soil was added to the based of the seedlings (hilling) to bury more plant nodes and stimulate the production of solons, which developed into tubers.

Seed tuber of Nicola was planted as a control to the transplanted seedlings from TPS. Experimental design was randomized complete block with 4 replications. Plot size was 2 m x 6m. Intra-row plant spacing was 25 cm on

rows spaced 1 m apart. Scores of 1-5 was used to record late blight, bacterial wilt and aphid attacks on plants, where 1 = no disease or pest attack, and 5 = complete destruction of potato plant by disease or pest. Percentage seed germination in laboratory, seedling emergence after planting in nursery and field establishment of seedling after transplanting were also recorded. Fresh tuber number and weight at harvest were recorded.

RESULTS

Analysis of soil from the experimental site showed low N and P (Table 1)

Table 1: Nutrient Status of Kuru Soil before planting

Year	Soil Depth (cm)	% Organic matter	% Total N	Soil pH	Available P(ppm)	Exchangeable K	Ca	Mg (PPM)
1997	0-15	1.7	0.14	5.5	3.3	95	591	89
	15-30	0.7	0.07	5.2	2.1	78	380	61
1998	0-15	1.6	0.10	5.4	2.7	100	570	84
	15-30	1.2	0.0	5.1	1.7	87	359	60

Table 2: Average Rainfall, Temperature, relative Humidity and Sunshine of Kuru (1996 to 1999)

MONTHS	RAINFALL (MM)	TEMPERATURES MAX	MIN	RELATIVE HUMIDITY (%)	SUNSHINE (HOURS)
January	0	20.3	10.1	48.0	9
February	0	23.0	11.8	55.0	8
March	0	26.5	12.8	68.0	8
April	65	27.0	15.8	70.0	8
May	210	24.6	16.9	76.0	7
June	215	24.6	16.5	78.0	6
July	319	24.5	17.3	81.0	6
August	398	22.6	15.6	89.0	5
September	279	23.2	14.1	95.0	4
October	68	24.3	13.3	85.0	6
November	0	22.1	12.2	69.0	8
December	0	21.8	10.7	55.0	9
Mean	129.5	23.7	13.9	72.4	7

Soil organic matter was also low, but exchangeable bases, especially K was moderately high. Table 2 shows the average weather data for the experimental site in 1997 and 1998.

Seed Germination and Seedling Emergence

The result showed an average seed germination of 81.1% for the TPS genotypes, with CIP 387705-18, Br. 63-18, Kondor and Rc 767.2 performing best in decreasing order CIP 387705-18 and Br. 63-18 also had the highest seedling emergence (Table 3) Percentage seedling emergence in the nursery was generally lower than the seed germination. Field establishment of seedling after transplanting ranged from 51.4% for VC 785-2 to 85.3% for Br. 63-18 (Table 3). Field establishment showed significant differences among the TPS genotypes. Percentage establishment of Nicola (seed tuber) was 96.4% and this was significantly higher than those of the TPS genotypes. Percentage establishment of Nicola (Seed tuber) was 96.4% and this was significantly higher than those of the TPS genotypes.

Table 3: Average Seed Germination, Percentage Emergence and Field Establishment of Tr..nsplanted true Potato Seed (1997 and 1998).

TRUE POTATO SEED GENOTYPES	% SEED GERMINATION (10 DAP)	% SEEDLING EMERGENCE (14 DAP)	% ESTABLISHMENT AFTER TRANSPLANTING (4 WAT)
RC 767-2	88.9a	67.8c	64.3e
Kondor	89.7a	71.3c	73.0ed
Roslin Ruaka	54.5e	50.4d	76.0ed
VC 783-2	71.3b	64.8c	51.4f
VC 801-4	77.6b	65.3c	79.3bc
Br. 63-18	91.8a	83.6b	85.3b
CIP 387705-18	93.6a	87.6ab	68.4de
Mean	83.4	73.4	74.3
SE	2.6	4.4	3.8

Figures in the same column followed by the same letter are not significantly different (Duncan's Multiple Range Test, DMRT).
DAP = days after planting
WAT = Weeks after transplanting

Diseases Resistance

Diseases and pests attack of seedlings from TPS were generally low (Table 4). Scores for early blight, late blight, bacterial wilt and aphids ranged from no attack to 25% attack of the potato seedling (Table 4).

Table 4: Severity of diseases and pests infection of true potato seedlings (1997 and 1998).

True Potato Seed Genotypes	Early Blight (10 Wap)	Late Blight (8wap)	Bacterial Wilt (8wap)	Aphid (8 Wap)	Tuber Rots (10 Wap)
RC 767-2	2a	1b	1b	1a	2a
Kondor	2a	1b	3a	1a	2a
Roslin Ruaka	1a	1b	1b	2a	1a
VC 785-2	1a	1b	1b	2a	1a
VC 801-4	1a	1b	1b	1a	1a
Br. 63-18	2a	1b	1b	2a	1a
CIP 387705-18	2a	1b	1b	1a	1a
Nicola	2a	1b	2ab	2a	2a
Mean	1.6	1.0	1.4	1.5	1.4
SE	0.2	0.1	0.5	0.4	0.3

Figures in the same column followed by the same letter are not significantly Different (Duncan's Multiple Range Test). Scores 1-5: 1: free from disease or pest attack; 2: 25% of plants or tubers attacked; 3: 50% of plants or tubers attacked; 4: 75% of plants or tubers attacked; 5: 100% of plants or tubers attacked. WAP – Weeks after planting.

Only the seedling of Kondor was significantly damaged by bacterial wilt. Seedling from other TPS genotypes responded similarly to the attack of bacterial wilt. Only VC 801-4 was free from the attack of all the diseases and pest studied. Nicola had the highest attack of bacterial wilt and late blight, but scores for other diseases and pest attacks were low (Table 4).

Tuber Yield

Nicola had higher tuber yield and more ware tubers than any of the varieties established through TPS (Table 5)

However, among the genotypes from TPS, CIP 387705-18, RC 767-2 and Br. 63-18 had the highest tuber yield, while Roslin Ruaka and VC 785-2 had the lowest yields. RC 767-2 had highest proportion of ware size tubers. Tuber number/ha of Ncola was similar to that of CIP 387705-18, Vc 8801-4, Kondor and Rc 767-2 with Br. 63-18 having the highest number of tubers/ha (Table 5). The dry matter of tubers from TPS were statistically the same (P=0.05). The uniformity of Nicola in colour and shape was 100%, while that of tubers from TPS ranged from 80-897% in shape. With exception of RC 767-2 and CIP 387705 –18 the skin colour of the TPS genotypes were not uniform (Table 5). The uniformity of Nicola in colour and shape was 100%, while that of tubers from TPS ranged from 80% to 97% in shape. With the exception RC 767-2 and CIP 387705-18 the skin colour of the TPS genotypes were also mixed (Table 5).

DISCUSSION

Soils in Jos Plateau are volcanic in origin and rich in K, but low in N and P (Enwezor *et al.*, 1990). Peak rainfall period is between July and September when it is difficult to grow susceptible potato cultivars without adequate

fungicidal protection from blight (Nwokocha and Zaag, 1986). The minimum temperatures for the period September to March were within the level of 15-20^{0}c recommended for potato production in the tropics (Borah and Milthorpe, 1962).

Table 5:Characteristics of Potato Tubers Produced from true Potato Seed (1997 and 1998)

True potato seed genotype	Tuber shape	Tuber skin colour	Depth of eye	% Dry matter	Tuber No/ha (x10,000)	Tuber yield (t/ha)	% Tubers >50 mm (ware tubers)
Rc 767-2	80% oval	100% Cream white	Deep	20.7a	27.9ab	9.0bc	38.3a
Kondor	90% Oval	96% red	Shallow	19. 8a	21.4bc	7.2cd	25.7bc
Roslin Ruaka	95% round	95% cream white	Shallow	18.9a	15.3c	4.5e	15.1cd
VC 785-2	85% Oval	90% cream white	Shallow	19. 1a	16.8c	6.3de	11.4d
VC 801 – 4	80% Oval	98% cream white	Shallow	19.0a	24.7b	7.6cd	19.4c
Br. 63-18	96% round	97% cream white	Shallow	18.7a	31.8a	8.9bc	9.8d
CIP 387705-18	97% Oval	100% cream white	Shallow	20.3a	25.0b	10.4b	28.9b
Nicola	100% Oblong	100% cream white	Shallow	18.7a	27b	14.8a	43.8a
Mean				19.4	23.7	8.6	24.1
SE				2.4	3.1	1.8	2.5

Figures in the same column followed by the same letter are not significantly different (Duncan's Multiple Range Test, (DMRT)

Germination test of the TPS genotypes was carried out under laboratory conditions. Higher percentage seed germination than seedling emergence in the nursery may therefore be due to better condition provided for the transplanting. Seedling of VC 801-4 and Br. 63-18 established better than VC 783-2. Accatino (1980) reported that establishment of TPS seedling may be low if soil temperature is high. In this study some seedlings were observed to die after transplanting as a result of irregular rains and high temperature (30-35^{0}c).

Tube yield of Nicola grown from seed tubes and the percentage of large size tubers were higher than those of the TPS genotypes which yielded smaller tubers except for RC 767-2 The result agrees with that of Burton (1989) indicating that the yield of TPS

seedling crop was lower than potato crop propagated from healthy seed tubers. The tuber from TPS also differed in colour, shape and cooking quality because potatoes planted from TPS are known to segregate (Burton, 1989; Okonkwo, 1999).

Diseases and pest scores showed that most of the TPS seedling were not seriously attacked by early and late blight, bacterial wilt and aphids. This agrees with the work of Burton (1989) who reported that the spread of soil and tuber borne diseases may be avoided by the use of true seed. Virus x, y and leaf roll are not spread by true seed, but spindle tuber viroid and virus T can be spread by true seed (Burton, 1989). Harvest loss due to tuber rots was also low. Nicola grown from seed tubers showed more symptoms of late blight and bacterial wilt attack than the TPS genotypes. The bacterial wilt might have come from the seed tuber planted or the soil, while late blight might survive in soil or volunteer potato, egg plant or pepper (Okonkwo et al. 1995).

This study showed that it is possible to grow seed potato tubers from true potato seed under Jos Plateau, Nigeria conditions. Among the TPS genotypes studied, CIP 3587705-18 and RC 767-2 are recommended because of their uniform skin colour, low disease attack, high tuber yield and high percentage of large tubers in the yield.

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