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POTATO YIELD AS AFFECTED BY PLANTING AND HARVESTING DATES UNDER CENTRAL SAUDI ARABIA CONDITIONS

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ABSTRACT

This study contains four field experiments; two planting and two harvesting dates. The experiments were conducted during the spring seasons of 1997 and 1998, and during the autumn seasons of 1997/1998 and 1998/ 1999. The aim of this study was to test the reproductive performance of Ajax potato cultivar under the semi-arid conditions of central Saudi Arabia. The results indicated that there were considerable variations among the different planting and harvesting dates. Planting date experiments during spring seasons showed that the middle of January gave the highest yield, while the yield was reduced towards the last planting date. Autumn planted potatoes gave their highest yield when planted on 10th of October, while those planted at the beginning of September gave the lowest tuber yield. Harvesting time experiments showed that the longer the crop remained healthy in the soil, the higher the yield and the more mature tubers will be at final harvest. When crop remained in the soil 105 or 120 days instead of 75 or 90 days, yield was doubled. Wet autumn season had a higher production than dry season. Also, the study indicated that autumn planted crop is better in yield than the spring.

Key words: *harvesting date, planting date , potato, yield.*

1. INTRODUCTION

Potato (*Solanum tuberosum* L.) originated in the Andean highlands of South America. Analysis of ancient living sites has confirmed that potatoes have been cultivated there for at least 8,000 years. Today, potato is a crop of major significance in human nutrition, ranking fourth in world production, after wheat, corn (maize) and rice. Potatoes are grown over 44 million acres in more than 125 countries, with annual production of about 250 million tons (Rowe, 1993). Among 10 top food crops, potato ranking first in terms of energy and third in terms of both dry matter production and protein content (Van der Zaag, 1991). In 1994, Saudi Arabia imports were 99463 MT and exports were 9049 MT of potatoes (FAO, 1994). Potato production is determined by several factors; one important factor is the growing season length. This could be altered by planting and harvesting dates. Planting time depends largely on climatic conditions. In areas like Saudi Arabia, where the growing seasons are shorter than what is required for the potato crop, planting and harvesting dates must be carefully chosen. In this respect, the growing seasons differ. In the central part of Saudia Arabia, potatoes are grown during two seasons, spring and autumn. Determining the planting and harvesting dates will, eventually, determine the growing period length, and the duration of crop foliage exposure to light. Monteith (1977) reported that the harvested dry-matter yield of a crop is the product of the radiation intercepted. Van der Zaag (1991) reported that one of the production components is the cumulative intercepted light.

Some growers prefer the early yield in respect to marketing considerations. Therefore, it is of interest to study the suitable planting and harvesting dates, which will meet the best requirement for both production and marketing.

2. MATERIALS AND METHODS

Experiments in this study were carried out at Al-Qassim area at the middle region of Saudi Arabia (26° 5N, 44° E, 725 m above sea level) on an alkaline sandy loam soil containing 86.6% sand, 0.4% silt and 13.0% clay. The soil of the experimental sites were chemically analyzed and the following values were recorded; pH ranged from 8.2 to 8.6, the range of the available N, P and K were 13-17, 15-18 and 31-43 ppm, respectively. Every planting date experiment consisted of six treatments, each treatment was repeated three times every season, while each harvesting date experiment consisted of four treatments and each treatment was repeated three times each season as well. The exeprimental area was 4.5 x 4.5 m, arranged in a complete randomized plot design. These experiments were carried out to determine the suitable planting and harvesting time of potato crop under Al-Qassim environmental conditions for both spring and autumn seasons. The spring planting date was 1st January and the harvesting date was 15 th April in both years, while autumn planting date was 1st October and harvesting date was 15th January. in both years.

3. RESULTS AND DISCUSSION

Temperature in the experimental site decreased steadily from September to January then it started to increase until August for both years (Table 1). This time coincided with the growth period of potatoes.

3.1. Effect of planting date on potato yield

It is clear that the second and third sowing dates for both years during the spring season (Table 2) exhibited the highest yield. Thus, it seams that the middle of January is the best time for planting potatoes during the spring season. Early and late January were not as good as the middle of January, but they were significantly better than February plantings (Table 2). The lowest yield was exhibited by the last planting date, which is less than one forth of that exhibited by the best planting date.

Table (1): Monthly average temperature and total rainfall at the experimental site during the years 1997 and 1998.

Month	Temperature (C°)		Rainfall (mm)	
	1997	1998	1997	1998
Jan.	13.43	12.40	011.30	22.90
Feb.	12.49	14.90	000.00	00.00
Mar.	16.95	18.70	040.60	52.60
Apr.	23.55	34.90	012.70	10.65
May	29.53	29.70	007.60	13.00
Jun.	34.96	34.10	000.00	00.00
Jul.	34.13	34.60	000.50	00.00
Aug.	33.36	36.80	000.00	00.00
Sep.	33.25	33.90	000.00	00.00
Oct.	27.06	25.50	033.50	00.00
Nov.	18.44	22.00	117.10	03.00
Dec.	13.92	17.60	017.30	00.00

Table (2) :Tuber yield (tons/ha) as affected by different planting dates during spring season.

Planting dates	1997	1998	Mean
01 Jan.	22.577 C	25.437 B	24.007b
10 Jan.	27.303 AB	33.197 A	30.250a
20 Jan.	28.677 A	29.443 A	29.060a
30 Jan.	23.940 BC	23.463 BC	23.701b
10 Feb.	11.647 D	19.783 C	15.715c
20 Feb.	06.243 E	08.767 D	7.505d
LSD	03.851	04.446	4.572
Mean	19.024	21.887	

* Means which are followed by the same letter are not significantly different (p=0.05) according to Duncan's multiple range test.

For the autumn season the highest yield was exhibited by the fifth planting date for both1997 and 1998 (Table 3). A very close result was obtained by Jaiswal in India (1995) who conducted his experiment under similar temperature conditios. Also when another experiment was conducted in India by Nandekar and Sharma (1998), they found that the best overall results for growth and yield were obtained with planting on the 20th or the 30th of October. These

findings almost agreed with our results, which could be ascribed to the weather factor, where the temperature became more suitable for plant growth and development towards October. The lowest yield was exhibited by the first and second planting dates for both years. The first planting date exhibited the lowest yield. However, this was not significantly different from the second planting date. The yield exhibited by the first planting date was about one third of that exhibited by the best planting date (Table 3). The best sowing date resulted in vigorous vegetative growth and tuber formation at the optimum temperature for potato production (Yamaguchi, 1983; Ng and Loomis, 1984).

Table (3): Tuber yield (tons/ha) as affected by different planting dates during autumn season.

Planting dates	1997	1998	Mean
01 Sep.	10.90 F	07.63 E	9.26f
10 Sep.	12.26 E	08.66 E	10.46e
20 Sep.	15.73 D	11.10 D	13.4d
30 Sep.	18.68 C	15.33 C	17.01c
10 Oct.	30.06 A	26.56 A	28.31a
20 Oct.	22.13 B	23.50 B	22.81b
L S D	00. 68	01.06	0.90
Mean	18.29	15.46	

*Means which are followed by the same letter are not significantly different (p=0.0 5) according to Duncan's multiple range test.

The highest yield was obtained when the plants were harvested 105 and 120 days after planting, for the spring season for both years (Table 4). Harvesting potato after 75 days and 90 days after planting resulted in very low yields. These yields were less than 50% of the yields exhibited by the later harvesting dates.

For the autumn season, the best yield was obtained when potato plants remained in the soil for a period of 120 days before harvest (Table 5). This followed by the proceeding harvesting date the yield, which was significantly lower than the last one, which was not significantly different from the following harvesting date.

Table (4) : Tuber yields (tons/ha) as affected by different harvesting periods during spring season.

Harvesting after	1997	1998	Mean
75 days	06.23 C	06.017 B	6.12b
90 days	09.80 B	08.083 B	8.94b
105 days	22.73 A	22.760 A	22.74a
120 days	22.70 A	20.433 A	21.56a
L S D	03.256	03.424	3.46
Mean	15.36	14.32	

*Means which are followed by the same letter are not significantly different (p=0.0 5) according to Duncan's multiple range test.

Table (5) :Tuber yields (tons/ha) as affected by different harvesting periods during autumn season.

Harvesting after	1997	1998	Mean
75 days	12.59 C	13.86 C	13.22c
90 days	14.20 BC	14.90 C	14.55bc
105 days	18.23 B	18.16 B	18.19b
120 days	23.78 A	26.63 A	25.20a
L S D	4.678	3.070	4.12
Mean	17.20	18.3	

*Means which are followed by the same letter are not significantly different (p=0.0 5) according to Duncan's multiple range test.

The yield exhibited by the first harvesting date was about 50% of that exhibited by the best harvesting date indicating that the differences between the harvesting dates were not so critical as for the spring season (Tables 4 and 5). These results are very much matching with results found by Babu *et al.*, (1990). As expected, the delay of the harvesting time would extend the growth period and hence would allow for more assimilate carbohydrate formation in leaves and its translocation down to the tubers (Van der Zaag, 1991). The yield of potatoes planted at autumn season 1997 is higher than yield of 1998 (Table 3); this could be ascribed to the positive effect of rainfall during the early growing stages of the crop at autumn 1997. Curwen (1993), reported that potato plant is sensitive to relatively

small changes in soil moisture. This sensitivity is likely due to its rather shallow root system and its physiological responses to moderate plant water deficit.

Tables (4) and (5) indicated that autumn yield was higher than spring yield, which could be due to the weather effect where it was cold in January, February and March, near the crop maturity. Yield showed an increase as weather became suitable. Some limiting factors such weather are very important for healthy plant and maximum yield (Rowe, 1993).

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تأثير مواعيد الزراعة والحصاد على محصول البطاطس تحت ظروف المنطقة الوسطى من المملكة العربية السعودية

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ملخص

تحتوي هذه الدراسة على أربع تجارب حقلية؛ تجربتان لمواعيد الزراعة وتجربتان لمواعيد الحصاد، أجريت خلال موسمي الزراعة الربيعي 1997و 1998 و الخريفي 1997/ 1998م و 1998/1999م وذلك لاختبار إنتاجية صنف البطاطس أجاكس تحت الظروف البيئية لمنطقة القصيم، في المنطقة الوسطى من المملكة العربية السعودية.

أظهرت النتائج أن النباتات التي زرعت في منتصف يناير أعطت أعلى إنتاجية بالنسبة للموسم الربيعي، ثم تناقص المحصول كلما تأخر موعد الزراعة. أما بالنسبة لموعد الزراعة الخريفية فان النباتات التي زرعت في 10 أكتوبر فقد أعطت أعلى إنتاجية، ولكن النباتات التي زرعت في شهر سبتمبر أعطت أدنى إنتاجية.

ومن ناحية تجارب الحصاد فقد أثبتت الدراسة أنه كلما زادت مدة بقاء النبات سليماً في التربة كلما زادت إنتاجيته؛ فالنباتات التي حصدت بعد 105 أو 120 يوما من الزراعة أعطت ضعف إنتاجية النباتات التي حصدت بعد 75 أو 90 يوما من الزراعة. كما أن هناك ما يدل على أن كمية الأمطار الساقطة في المراحل الأولى من الزراعة الخريفية لها تأثير إيجابي في إنتاجية البطاطس في ظل ظروف شبيهة بظروف هذه التجربة.

كانت الزراعة الخريفية أفضل إنتاجية من الزراعة الربيعية ربما بسبب طول موسم نمو الزراعة الخريفية وسرعة حصاد المحصول الربيعي عند دخول فصل الصيف وارتفاع درجة الحرارة.

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