YIELD OF IRISH POTATOES (*SOLANUM TUBEROSUM*) AS INFLUENCED BY INTRA ROW SPACING AND NITROGEN SOURCES AND LEVELS IN VOM, PLATEAU STATE

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Abstract
This study examined the effects of intra-row spacing and nitrogen sources and levels on the tuber yield of Irish potato in Vom. Three nitrogen sources and levels (NPK 0.82,0.92,1.02, Urea 0.2,0.3,0.4, Poultry Liters 3.95,4.05,4.15) and three different intra-row spacings (20cm, 30cm, 40cm) were factorially combined into 27 treatment combinations and laid out in a Randomized Complete Black Designs (RCBD) with three replications. Data collected include tuber weight and tuber count per stand. Results analysed using Analysis of Variance (ANOVA) . Result obtained indicated that poultry liters at 4.05g/plt in two spilt doses and using 40cm intra-row spacing produced Irish potatoes Plant with significantly ($P \leq 0.05$) higher tuber count and weight than other treatments. It is suggested therefore farmers who wish to grow Irish potatoes should use 40cm intra-row spacing and during manuring they should use poultry litre at 4.05 kg/pt applied in two spilt doses for optimum yield.
Keywords: Irish potatoes, intra-row spacing, nitrogen sources

Introduction
Irish potato *Solanumtuberasum*, is grown on a worldwide basis and is ranked as the fourth most important food crop in the world. The crop is thought to have originated in the Indean highlands to Bolivia and Peru, although today it is greatly produced in the temperate zones (O'brain and Allen, 2009).

Potato production has made a rapid expansion into tropical and sub-tropical zones for several reasons. Potato produces more energy per unit of time than almost any other crop including maize and cassava. They are in high demand in the third world and command a good price. The utilization of potato in Ethiopia is very popular for consumption of boiled potato, it is now extensively used in the wide arrays of traditional stew (wet) preparations Sin both rural and urban areas. It is a major source of inexpensive energy and produces more food per unit of the crop, it is mainly produced on fertile soils but also grown on sandy soils both under irrigation and rain fed conditions (O'brain and Allen, 2009).

In Nigeria, Irish potato is very popular and is of high demand especially in the west mostly because of the cosmopolitan nature of the area, it is mostly used for chips, portage, and for many other food recipes. Of recent, it was discovered that the moisture content in the potato tuber could be used as an electrolyte, providing about 0.5 ml per tuber (Kabir *et al*., 2015).

In Jos, potato is one of the major crops cultivated by farmers, thereby producing income to the farmers on the plateau, who sell within and outside the country (Kabir *et al*., 2015). In 1991, about 400,000 tons of potato was gotten from Nigeria with 95%

of the output coming from Jos. Currently, production estimate is about 800,000 tones. This is a good development, and can still be improved on, by creating better cultivating conditions such as optimal intra-row spacing, nitrogen source and level.

With this in mind, this study is designed to:-

1. Determine the effect of intra row spacing on the tuber count and weight (per plant) of Irish potatoes.
2. Determine the effect of Nitrogen sources and levels on the tuber count and weight (per plant) of Irish potatoes.
3. Determine the interactive effect of intra row spacing and Nitrogen sources and levels on the tuber count and weight of Irish potatoes growing in Vom, Plateau State.

MATERIALS AND METHODS

Source of seeds; Marabel variety of Irish potato was obtained from the National Root Crops Research Institute (Potato program), Vom

Source of fertilizer; N.P.K and Urea were sourced from local markets in Bukuru, Jos Plateau State while poultry litters were obtained from the College Farm, Federal College of Animal Health and Production Technology, Vom.

Source of agro-chemicals; Assorted agro-chemicals (FlouzefobP.butyl), Maucozeb^{+} and Ridomil) were sourced from Jeochems' technicalsources Jos, plateau state.

Other inputs: weighing scale, knapsack sprayer, hoes, were sourced from the College Farm while rulers, graph sheet, twines, pegs were obtained from local markets in Vom, Plateau State.

Land preparation

The land was ploughed, harrowed and prepared into experimental plots using tractor, disc plough, disc harrow, ridger, hoes and pegs.

Experimental design

The treatments (spacing- 0cm,30cm,40cm) and Nitrogen sources and levels (urea 0.2, 0.3, 0.4, N. P. K. 0.82, 0.92, 1.02, poultry litters 3.95, 4.05, 4.15) were factorally combined into 27 treatments and laid out in a Randomized Complete Block Design (RCBD), S1 N1 L1, S1 N1 L2, S1 N1 L3, S1 N2 L1, S1 N2 L2, S1 N2 L3, S1 N3 L1, S1 N3 L2, S1 N3 L3, S2 N1 L1, S2 N1 L2, S2 N1 L3, S2 N2 L1, S2 N2 L2, S2 N2 L3, S2 N3 L1, S2 N3 L2, S2 N3 L3, S3 N1 L1, S3 N1 L2, S3 N1 L3, S3 N2 L1, S3 N2 L2, S3 N2 L3, S3 N3 L1, S3 N3 L2, S3 N3 L3 and Replicated three times.

The seeds were sown based on the treatments.

Fertilizer application

Different sources and levels of fertilizer were applied base on treatments one day after planting and four weeks after planting.

Data collection and Analysis

Tuber Count: Tubers from five randomly selected plants from the net plot of each experimental unit were counted and recorded.

Tuber Weight: The weight of the tubers from five randomly selected plants from the net plots were weighed and recorded.

Data collected was subjected to Analysis of Variance (ANOVA) to determine significant difference between treatments. The level of statistical significance was accessed as a = os. Where differences exist significantly, DMRT, Was used to separate the means.

RESULTS AND DISCUSSION

Table 1: Effects of intra-row spacing and Nitrogen sources and levels on the tuber count of Irish potato grown in Vom, 2016 (n = 3, mean ±SEM)

	SPACING				
Nitrogen sources and levels	**20CM**	**30CM**	**40CM**	**Total**	**Mean**
Urea 0.2kg	4.80	4.00	3.93	12.73	4.24[c]
Urea 0.3kg	4.80	4.00	3.80	12.60	4.20[c]
Urea 0.4kg	4.30	3.40	4.80	12.50	4.17[c]
NPK0.82kg	3.90	4.60	3.97	12.47	4.16[c]
NPK0.92kg	4.00	3.42	4.30	11.72	3.91[d]
NPK1.02kg	3.37	3.73	5.30	12.40	4.13[c]
PL3.95kg	6.30	4.20	3.47	14.20	4.73[b]
PL4.05kg	4.60	4.15	5.97a	14.72	4.91[a]
PL 4.15kg	4.13	3.30	6.40	13.86	4.62[b]
Total	40.20	34.83	41.94	117.20	39.04
Mean	4.47[b]	3.87[c]	4.66[a]	13.02	4.34

Source: Field Data 2016

The effects of intra row spacing and nitrogen sources and levels on the tuber count of Irish potato grown in vom 2016 are presented in Table 1. The result showed that planting Irish potatoes at 40cm intra row spacing and applying poultry liters at 4.05g/plant produced Irish potatoes with significantly higher ($P \leq 0.05$) number of tubers than the other spacing (20 cm and 30 cm) and Nitrogen source and levels Table 1, 2).

This finding lends support to earlier reports by Handerse *et al* (1992) and Rex, *et al* 1987 who worked independently but corroborated that intra row spacing greater than 38cm yielded significantly greater number of oversized tubers in Irish potatoes. Kabir *et al.*(2015)also noted that soil nitrogen sources and split N fertilizer applications have a major role in maintaining an optimum plant canopy and tuber growth (O' brain, 2009). Yield of potatoes is known to be influenced by a number of factors which include; Nitrogen, cultivar, seed piece spacing, climatic conditions and geographical factors. As plant density increases to a certain level, there is a marked decrease in plant size and yield per plant. This effect is also known to be due to increased inter plant competition for water, light and nutrients. So the upper limit of 40cm intra-row spacing provide the optimum intra-row spacing in this report.

Similarly, availability of N in the soil is highly dependent on N mineralization (Khan *et al*, 2010) and N leaching processes. It may vary markedly during the growing season and somehow affect haulm branching (Love and Thompson Johns, 1999) and crop productivity. Also, different plant densities play an important role on plant N uptake, affecting yield quality and quantity, especially when considering potato seed production, usually oriented to produce small size tubers by reducing plant spacing.

Table 2: Effects of intra-row spacing and Nitrogen sources and levels on the tuber weight of Irish potato grown in Vom, 2016

	SPACING				
Nitrogen Sources And Levels	**20CM**	**30CM**	**40CM**	**Total**	**Mean**
Urea 0.3kg	0.37	0.22	0.17	0.74	0.25a
Urea 0.4kg	0.19	0.31	0.22	0.72	0.24a
NPK 0.82kg	0.21	0.15	0.18	0.54	0.18d
NPK 0.92kg	0.22	0.25	0.16	0.63	0.21bc
NPK 1.02kg	0.28	0.20	0.17	0.65	0.22b
PL 3.95kg	0.16	0.23	0.25	0.64	0.21b
PL 4.05kg	0.27	0.14	0.20	0.61	0.20bc
PL 4.15kg	0.18	0.21	0.25	0.64	0.21b
Total	0.21	0.19	0.18	0.58	0.19cd
Mean	2.09	1.88	1.78	5.75	1.91

Source: Field Data 2016

The effect of intra-row spacing and nitrogen Source and Levels on the tuber weight of Irish potatoes grown in Vom is presented in Table 2. The result showed that growing Irish potatoes on an intra-row spacing of 20cm and applying urea at 0.02kg per stand in 2 spilt doses produced Irish potatoes with significantly heavier weight ($P \leq 0.05$) of tubers than other treatments. (Rakemi *et al*., 2005) reported similar that yield increases with lesser seed spacing and higher Nitrogen rates. They reported that decreasing intra-row from 30cm to 15cm resulted in higher yield in the tuber weight of Irish potatoes.

This study also indicated that nitrogen sources and levels interacted positively ($P \leq 0.05$) for tuber count because Irish Potatoes spaced 40cm intra-row and using poultry liter at 4.05kg/M consistently produced Irish potatoes with significantly ($P \leq 0.05$) higher tuber count than other treatments.

Poultry liters is known to be a very good source of soil nitrogen and spilt nitrogen fertilizer application have a major role in maintaining optimum plant canopy and tuber growth (Wurr, 1974). However, there is little quantitative information available on how nitrogen affects expansion, final size and duration of different plant organs.

Potatoes are also known to be very responsive to NPK at planting and therefore balancing nutrition in such a manner often with Mg and Su as fuel applied at the same time ensure good start for the crop. This also gives support to the outcome of this study since poultry litter is known to be rich in all the trace essential elements.

It is suggested therefore that farmers who wish to grow Irish potatoes in the study area should use intra-row spacing of 40cm between plants and during fertilizer application, they should use poultry litter at 4.05kg/M applied in two splits doses, all before six weeks after planting for optimum tuber yield.

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