

Short Communication

Response of potato (*Solanum Tuberosum* L.) Varieties to planting dates in Semi-arid lowland Nigeria

Adamu Muhammad

Kebbi State University of Science and Technology, Nigeria. Waziri Umaru Federal Polytechnic, Nigeria.

Editor

Adamu Muhammad
Kebbi State University of
Science and Technology,
Nigeria. Waziri Umaru Federal
Polytechnic, Nigeria.

Abstract:

Potato is a temperate crop requiring low temperatures for growth and yield. Production of potato in the semiarid lowland Nigeria is restricted to periods of low temperatures that prevailed from early November to late February. The general approach for potato in this region is to relate the planting date to coincide with the period of relatively low temperatures, as high temperature inhibits growth and yield. Based on the above, field experiments were conducted in two locations at the Teaching and Research Farm of the Kebbi State University of Science and Technology, Aliero, during 2016/2017 dry season. The aim was to determine the most appropriate planting date and most suitable variety in the study area. Treatments consisted of factorial combinations of four Planting dates (1st November, 15th November, 1st December and 15th December 2016) and four potato varieties (Bertita, Diamant, Lady-christl and Nicola). The experiments were laid out in a Randomized Complete Block Design with three replications. Results revealed that stand count, plant height, number of leaves per plant, shoot dry weight, number of tubers per plant, weight of tubers per plant, mean tuber weight, mean tuber diameter and fresh tuber yield were higher when planted on 1st - 15th November. Bertita proved to be the most robust in terms of growth; and with Nicola, in terms of yield compared to the other varieties. Based on the results of this study, it could be concluded that, planting of potato from 1st November to 15th November coupled with either Bertita or Nicola give the highest potato yield in the study area.

Keywords

Solanum tuberosum, Savanna Ecological Zone, Tuberization, High altitude regions

Introduction

Potato (*Solanum tuberosum* L.) is a temperate crop belonging to Solanaceae family. Potato is the fourth most important food crop in the world [1]. It is believed to have originated from high plains of Andes Cordillera, where the Incas cultivated the crop largely for food. In tropical Africa, countries like Malawi, Rwanda, Kenya, Ethiopia, Cameroon, and Nigeria are among the main potato

producing areas, where potato is produced on commercial scale, particularly on high altitude regions where temperatures and humidity are relatively low and suitable for potato growth, development and yield. Potato introduction and cultivation in Nigeria began in the early 1920s by Europeans involved in tin mining on the Jos plateau [3]. In Nigeria, the area under potato cultivation during 2014 stands at 142,680 hectares of land with an average production of 1,184,865 metric tonnes. Farmers yield was about 8.3 t ha⁻¹ in Nigeria [3,4]. Over 85% of potato produced in Nigeria comes from Jos plateau. Other important potato areas include Biu and Mambila plateaus [5]. Potato is a highly cherished crop usually considered as a food for the rich in the lowland Northern Nigeria like Kebbi, Sokoto, Zamfara and the likes. However, its production is restricted to areas on high altitudes like Jos, Mambila and Biu plateaus; due to the relatively low night temperatures that prevail in these regions throughout the year which resulted to high cost of potato in north-western states. [3] Reported a huge potential for potato production in lowland Northern Nigeria but cautioned that its production can only be possible during cold dry season (Harmattan periods) that prevails from November to February in the Sahel and Sudan savanna regions of Nigeria. During this period, the temperatures are relatively low and conducive for economic production of the crop under irrigation [2]. Considering the variability of temperature and short (4 months) duration of the cold season, it is pertinent to relate planting date to coincide with the period of relatively low temperatures, as these high temperatures inhibit tuberization [6]. The overall performance of potato varieties is influenced through the size of its foliage, time of tuber initiation; and length of time the foliage remained alive and photosynthesizes thereafter; its inherent ability to partition assimilates to tubers, maturity period and response to environmental conditions [5]. No single variety possesses all the desirable production and post-harvest qualities. It is therefore assumed that growth; yield and quality of a particular potato variety are genetically controlled, but can be influenced by external factors such as fertilizer, irrigation, temperature, radiation, day length, planting date, pests and diseases [7]. Therefore, the choice of adapted and high yielding potato variety is vital for successful production. In order to have effective and efficient introduction programme for potato in the study area, a scientific research that evaluates some promising irrigated potato varieties for responses to different planting dates is necessary.

MATERIALS AND METHODS

Study area- The experiments were conducted at the University Teaching and Research Farm during 2016/2017 dry season. The two locations; Fadama Teaching and Research farm are located at Jega (lat. 12°12.99' N; long. 4° 21.90'; 197 m above sea level) and the University orchard at Aliero (lat. 12°18.64'N; long. 4°29.85'; 262 above sea level). Both Jega and Aliero are located in Sudan Savanna ecological zone of Nigeria. The areas possess long dry season that is characterized by cool dry air (harmattan), which prevails from November to February and hot dry air extending from March to May. The locations are mainly used for cultivation of vegetable and cereal crops. Minimum

and maximum temperature ranges were 18–29°C and 30–42°C, respectively. Minimum and maximum solar radiation ranges were 3.72 wm^{-2} to 4.56 wm^{-2} and 844.17 wm^{-2} to 976.840 wm^{-2} respectively. The relative humidity ranged from 26% to 39% and wind speed ranged from 1.9 to 5 ms^{-1} . Treatments and experimental design- Treatments consist of factorial combination of four potato varieties (Bertita, Diamant, Lady-christl and Nicola) and four planting dates (D_1 , D_2 , D_3 and D_4) corresponding to 1st November, 15th November, 1st December and 15th December, respectively. The treatments were laid out in a Randomized Complete Block Design with three replications. Cultural practices- Seed tubers for the four (4) potato varieties were sourced from Potato Research Program of the National Root Crops Research Institute (NRCRI), Vom sub-station, Jos, Plateau State. The seed tubers were pre-sprouted for 3–6 weeks before planting. The seed tubers were dressed with fungicide (Mancozeb powder at 2.0 a.i. kg ha^{-1}) a day prior to planting. Planting was done according to treatments. Whole or cut tubers of approximately 20 g were planted per hill at inter and intra-row spacing of 75 and 30 cm, respectively. Plots of 3.0 × 4.5 m (13.5 m^2) were marked out in each block, leaving 1.5 m space between blocks. Each plot was made into six ridges to be spaced 75cm apart. Water channels were constructed for the effective supply of water to each furrow during irrigation. The net plot areas consist of the two middle rows 1.5×3.0 m (4.5 m^2). The source of water was a tube-well. Water pump machine was used to draw water from the source (tube well) to the experimental field through the constructed water channels. Irrigation was scheduled at 3-6 days interval depending on the crop's need. A recommended dose of 600 kg NPK (20: 10: 10) ha^{-1} was applied in two equal split doses; at planting and at 4 Weeks after Planting (WAP), respectively. The fertilizer was applied 10 cm away from a plant stand at a depth 5cm and covered. Weeds were controlled manually using hoe as at 3, 7 and 10 WAP. Insects were controlled using Karate (Cypermethrim) sprayed at 4 ml L^{-1} of water. The crop was harvested by digging with hoe following a light irrigation a day to harvest in order to facilitate easy lifting of tubers.

RESULTS

The greater performance of Bertita, Nicola and Diamant in terms of number of tubers per plant; and the former two, in terms of weight per tuber and per stand as well as the overall fresh tuber yield could be linked to genetic make-up of the varieties [10]. Attributed potato tuber yield and related components to inherent genetic make-up of the varieties. Such genetically controlled variations among potato varieties were reported [3,11,12]. Temperature is the major limiting factor on potato production in the study area, as cool night temperatures (11–20°C) are required for tuber development and growth [13]. The number of tubers per plant, weight of tubers per stand, means tuber weight and tuber yield were positively increased with 1st and 15th November planting. These positive responses could be linked to lower temperatures that prevailed during critical potato developmental stages like tuber initiation and bulking (6–12 weeks after planting) which determined the overall tuber yield. The coolest periods of the season occurred from 15th to 31st January which

corresponds to 1st to 15th November planting dates. At that period (15th to 31st January), the crop was 8–12 weeks, giving it the conducive low temperatures which might have led to higher production of assimilate and their subsequent translocation and partitioning to tubers. Similar findings were reported by [3,10,14-16] . Most of the yield components were generally optimized with 1st–15th November planting dates in conjunction with Bertita and Nicola. These significant interactions with respect to number of tubers per plant, tuber weight per plant, mean tuber weight and fresh tuber yield could be due to the effect of low temperatures that prevailed during the critical potato growth stages (January) resulting from 1st to 15th November planting, coupled with the inherent yield potential of Bertita and Nicola. Similar results were reported.

CONCLUSIONS

Based on the results of this study, it could be concluded that planting of potato from 1st to 15th November coupled with either Bertita or Nicola gives the highest potato yield in the study area. Therefore, for maximum potato production in the study area, farmers should arrange to plant from 1st to 15th November, a delay in planting after 15th November could reduce yield by up to 34–47%. More so, Bertita and Nicola are the potato varieties that give high yield and therefore recommended to farmers in the study area. Ensuring sustainable potato production in the Northwestern region of Nigeria where the crop is highly cherished but can only be produced in the dry season during harmattan through irrigation when the temperatures are low.
