



Yield and Yield Components of Potato Response to Various Planting Date in Cambodia

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Abstract: Potato (*Solanum tuberosum* L.), a tuberous plant well known as a highly nutritional diet and an economic crop s, is the world's fourth largest production after rice, wheat and corn. Recent experiments have shown some potential places and varieties for cultivation in Cambodia. Thus, the experiment aimed to understand the response of the potential potato varieties to different planting dates in Sen Monorom town, Mondulhiri province (a mountainous area), Cambodia. The trail was laid out in randomized complete block design with 4 replications and 3 different planting dates namely October, November and December of 2018. The Coronada, certified seed from the Europlant International company in Germany, was the ideal variety used in the experiment and lasted 115 days from planting to harvest. Only the number of tuber per plant, tuber weight, weight per plant, and marketable yield were recorded. Suggested that planting date significantly affected to all measured parameters. Plot planting in December produced the highest number of tubers with an average of 9.3 tubers per plant while a similarity was noticed for October and November planting. However, the November planting surprisingly produced the highest weight per plant, heavier tuber and the highest marketable yield with 19.15 ton ha⁻¹. The two other planting dates obtained an average yield of 14.49 and 12.39 ton ha⁻¹ for October and December consequently. This is understandable that November planting and harvest at end February, which is the long cold and windy season with less rainfall, was the most comprehend planting season in Mondulhiri province, Cambodia.

Keywords: Mondulhiri, Coronada, upland, Cambodia, planting date

INTRODUCTION

Potato, *Solanum tuberosum* L., is the fourth largest production crop next after rice, corn and wheat (FAOSTAT, 2006), and the key crop for food security in many developed and developing countries

(Scott et al., 2000). At the present, potato production is expanding at an incredible rate throughout the world. Despite its popularity, the crop is not an easy success production in all places. Potato prefers a cool climate followed by a warm environment for the best massive production. Optimum yield has been observed in temperate regions with an average temperature around 18-20 °C without chill (Havetkort and Struik, 2015). In Cambodia, fresh potato is largely imported from Vietnam, Thailand and China. Production of potato was first introduced in late 2016 under an experiment by the Faculty of Agronomy at the Royal University of Agriculture (MAFF, 2016). In most hot and tropical countries, potato farming is recommended during the rainy and short rainy season, but most upland produced areas would not be benefit due to the threat of the soil borne disease such as late blight (Gebremedhin et al., 2008; Gildemacher et al., 2009). In association with climate change, several technology packages, and cropping calendar are keys to succeed and maintain the production (Monneveux et al., 2014). Global yield losses were estimated from 18 to 32% without adaptation in production technologies packages, or 9 to 18% without consideration of cropping calendar and use of heat tolerant varieties (Hijmans, 2003). Tiftonell et al. (2007) suggested that yield losses in most rainfed areas is generally largely due more to management aspects than to low physical potential. The optimum timing of the planting date is considered as one of the key factors that strongly affect potato production in a rainfed zone (Wang et al., 2008). Similar to other crops, the optimum planting date for potato is mostly specific to each production region. However, there was no scientific recommendation s-to adaptable varieties with consideration of the environmental condition in upland production areas in Cambodia, in particular, Mondulkiri province. Therefore, manipulation of the perfect timing of the planting date is the most important key to overcome the negative impact of environmental on potato production in Mondulkiri province, Cambodia. The present study aimed to determine the optimum planting date for potato production which can produce maximum yield under the upland climate of Cambodia.

METHODOLOGY

Experiments were carried out under field conditions from October 2018 to April 2019 at Mondulkiri province (12°28'27" N, 107°12'33" E). The site was 710 meters above the sea level. The trial was laid out in randomized complete block design with 4 replications. The treatment consisted of three different planting dates namely second week of October, November and December, respectively. Plant density was 4.8 plants/m² in plots of 12 rows, 0.70 m apart and 25 m long. Each plot was fertilized with 80 kg N ha⁻¹, 80 kg P₂O₅ ha⁻¹ and 150 kg K₂O ha⁻¹ at planting date and 40 kg N ha⁻¹ and 100 kg K₂O were applied at ridging (45 days after planting). Chemical and physical of the experiment field was described in Table 1. Weed and pathogens were controlled chemically at the manufacturer's recommendation rate to prevent biotics damage. The plots were surface irrigated during the growing season, according to weather station evapotranspiration data. Coronada, yellow flesh and skin color from Europlant International, Germany, were used and allowed to stand on the ground for 115 days from sowing to harvest. Marketable yield and yield components parameter were recorded. The key data was the number of tubers per plant, weight per tuber, weight per plant and marketable yield were measured at harvest.

Table 1 Soil physical and chemical properties analysis of experiment site

| EC | pH | P ppm | K cmol _c kg ⁻¹ | N % | SOM % | CEC cmol _c kg ⁻¹ | Soil Texture | | | |
|------|------|----------|---|--------|----------|---|--------------|------|------|--------------|
| | | | | | | | Clay | Silt | Sand | Class |
| 38.0 | 4.20 | 0.1 | 0.42 | 0.29 | 5.07 | 72.4 | 22.3 | 35.3 | 42.4 | Clay Loam |

Source; Soil Laboratory, Faculty of Agronomy, Royal University of Agriculture

RESULTS AND DISCUSSION

There was significantly different yield obtained due to variation of environmental condition during the October, November and December. The highest tuber produced was recorded for December planting while statistically similar were reported for October and November. The increase temperature during the vegetative stage led to an increase in the number of stolon which led to variation in the number of tuber produced per plant. In the upland environment in Cambodia, the temperature increase was normally observed from mid-January onward while the low temperature occurred from September or when the rain fell (September-November). Wolf et al. (2017) emphasized that increased temperature for 20 days at tuber development could affect the number of tuber produced depending on genotype.

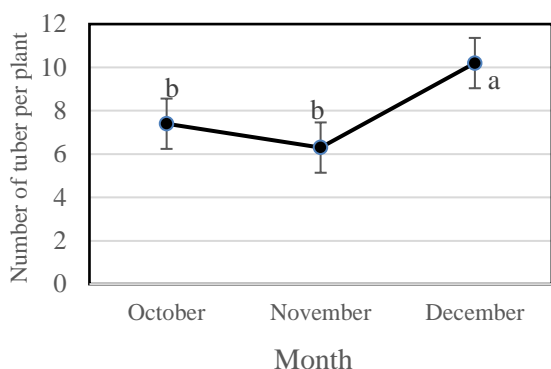


Fig. 1 Result of tuber number per plants

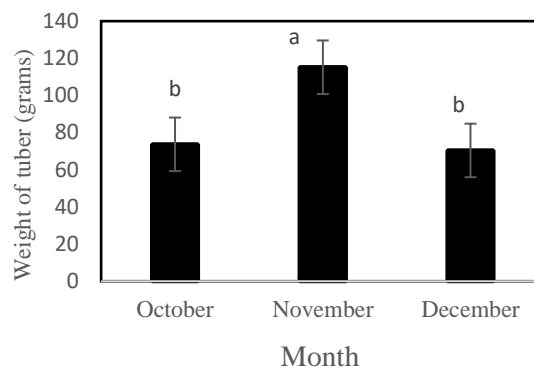


Fig. 2 Result of weight of tuber

November planting produced larger and heavier tubers than any other planting date (Fig. 2). Higher temperature aboveground over the potato favor limited tuber enlargement, which result in reduced in tuber per plant (Wolf et al., 1991; Basu and Minhas, 1991). At a higher little temperature than 28 degrees Celsius, only 50% of assimilates produced were transferred to tubers, whereas 20% more of assimilates were translocated at an optimum temperature of 18 °C (Randeni and Caesar, 1986). Thus, planting potatoes in November in the upland environment of Cambodia attained the highest yield which was about 19 ton per hectare. A Decrease in marketable yield was observed for October planting which was similar to December cultivation. The result showed that November was the optimum season which was 25-35% higher than growing during October and December.

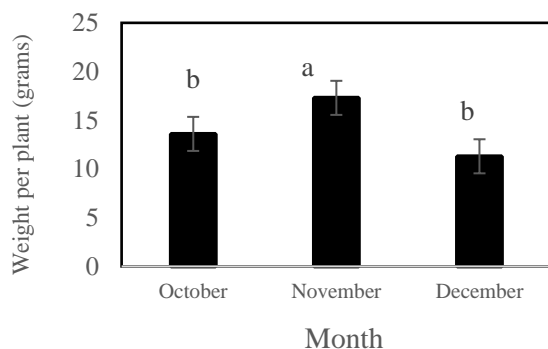


Fig. 3 Average weight of tuber per plant

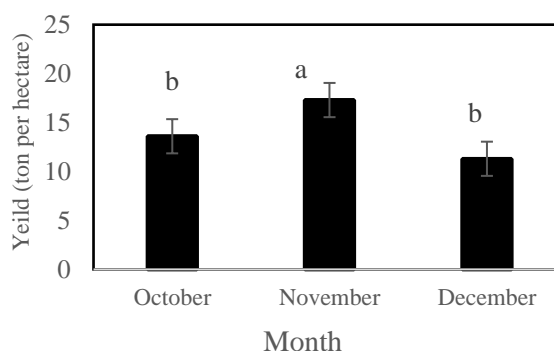


Fig. 4 Average marketable yield

Yield of the potato was relatively low due to infection by soil borne disease such as late blight. Optimum growth and yield of potato was obtained in the tropical region when there was not much rain and a cool dry climate. October was considered the main rainy season in Cambodia, with many rainy days and high precipitation (Fig. 5). The Number of rainy days started to decrease form November and little or no rainfall could be observed from middle of December and temperatures started to increase. In most hot and tropical countries, potato farming was recommended during the rainy and short rainy season, but most upland produced areas would not benefit due to the threat of the soil borne disease such as late blight (Gebremedhin et al., 2008; Gildemacher et al., 2009).

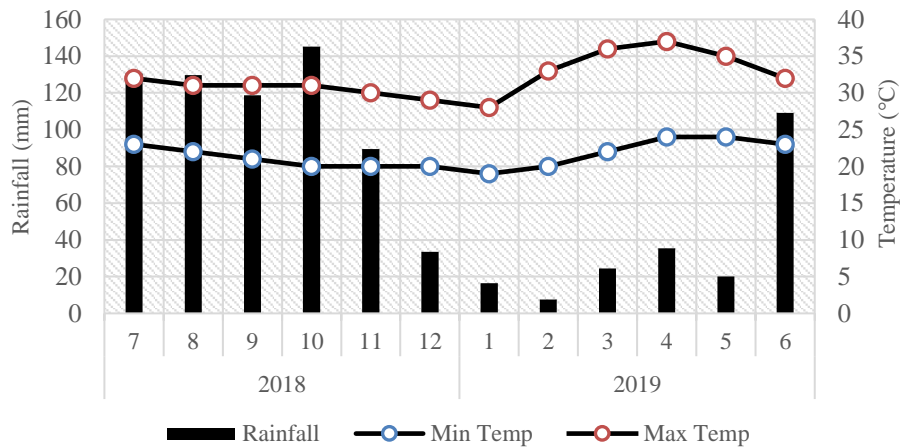


Fig. 5 Climate condition during the experiment

CONCLUSION

Our results is suggested that November was the optimum season for potato farming in upland environment at Mondulkiri province, Cambodia. Planting potatoes in this season produced large tuber and maximum yield with less damage from soil borne disease due to fewer rainy days and warm temperature without chilled or exposing the potato to high temperature. October planting was considered the second option, however well drainage system and chemical prevention need to be prepared to prevent crops from damage by excess water and spread of disease. In addition, for December planting, variety was the key to obtaining better yield due to increase in temperature during tuber bulking (45 day after sowing). Short and medium varieties are highly recommended, while long varieties are highly exposed to low productive and crops failure.

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