ABSTARCT

Potato (*Solanum tuberosum L.*) is one of the most important food crops in India and world. The yield of potato tuber is dependent on cultivation practices and weed management practices. The potato growing farmers prefers to plant cut tubers to reduce the seed requirement and cost incurred for seed tubers. Presently, the cut tuber seed pieces were planting by random dropping in to the furrows through planters, which drastically affecting the tuber germination and tuber yield. A field study of planting cut tubers by orienting the sprout-eye at 90±30°, 0° or 180°, 270° angles, random drop and whole tuber planting was conducted during winter season of 2017-18 and 2019-18. As weed management practice, application of metribuzin at 0.75 kg a.i./ha as pre-emergence (PE) herbicide followed by (*fb*) earthing-up, Paraquat (post-emergence) @ 5% of crop emergence *fb* earthing-up and 2 earthing-up operations alone (Control) was also incorporated to develop a novel potato planter which does turning of cut tuber sprout-eye to optimum angle, planting of turned tuber piece in furrow and simultaneous application of PE herbicide over the bund formed by planter. It was observed that, the orientation of sprout-eyes at 90±30° or at 180° gives plant germination percentage of 93.6 to 95.33% and took mean germination time of 18.5 to 18.71 days. The down ward facing of tuber sprout-eye increased the time required for germination. Therefore, the MGT in 270° are 13.7% higher than whole tuber, 12.5% higher than 90±30° and 11.5% higher than 0 or 180° treatments. The application of metribuzin @ 0.75 kg a.i./ha as pre-emergence herbicide followed by 2 hours of sprinkler irrigation controlled the weeds effectively at 25 and 55 DAP over other weed management practices. The operational cost can be reduced by 1.4 to 2%, if PE sprayed along with tuber planting. The upward facing of tuber sprout-eyes yielded highest large tuber yield of 11.11 and 10.68 t/ha in 0 or 180° treatment, followed by 11.08 and 10.63 t/ha on 90±30° respectively during first and second year of study. This yield in 270° treatment was 35.7 to 41.1% lesser compared to 90±30° and 35.8 to 39.6% lesser compared to 0 or 180°. The random drop treatment shows slightest increment over the 270°; however their yield was statistically at par. A statistical at par marketable tuber yield was recorded in whole tuber, 90±30° and 0 or 180° treatments during the study period. Thus, the potato cultivation by planting the cut tubers at 90±30° and 0 or 180° sprout-eye orientation is as much effective as potato cultivation by planting whole tuber. Thus, the tuber sprout-eye orientation is optimized to 60 to 180° (90±30° and 0 or 180°) angles. Among weed

management practices the metribuzin @ 0.75 kg a.i./ha gives statistically highest marketable tuber yield. Therefore, planting of tubers by orienting the sprout-eyes to optimum angle and application of metribuzin @ 0.75 kg a.i./ha gives more marketable tuber yield.

To achieve a maximum uniformity index (lesser CV%) we have to select a more irregular shaped tubers, medium size cup (diameter of 54 mm and depth of 21 mm) and lower operating speed of metering unit. The medium cup relatively performed better, had 33.9% lesser tuber doubles than larger cup and 40.1% lesser tuber skips than small cup. Further it also had lesser CV than large and small cups. A highest TE of 97.7% was obtained at 0.21 m/s. At 0.21 and 0.35 m/s, TE was 3.9 and 2.3% higher compared to 0.49 m/s of speed. The long shaped tubers had highest TE of 95.78%. Lower peripheral speed of metering unit (forward operational speed of planter) and more irregular shaped tubers are recommended to achieve higher TE and lower CV%. A 100% plant emergence with 18.5 to 18.51 days of tuber mean emergence time was observed in machine tested seed tubers under pot study. Thus, machine can be used for planting effectively. Under field evaluation, at lower speed i.e. 1.5 km/h the mean spacing between adjacent tubers was almost nearer to the desired spacing i.e. 20 cm. The performance of planter at 2.5 km/h operational speed, tuber doubles values were same as of 1.5 km/h and tuber skips and QFI were statistically at par with 1.5 km/h. TE does not affected by operational speed of developed planter. However, the highest TE% of 84.37% was obtained at speed of 1.5 km/h, followed by 2.5 km/h (84.1%) and 3.5 km/h (83.34%). A highest SI of 85.88 was recorded at higher operational speed i.e. 3.5 km/h and lowest of 37.29 was recorded at 1.5 km/h. Therefore the developed planter may be operated at 1.5 to 2.5 km/h speed to obtain better performance. The developed planter costs around Rs. 95,000 and having field capacity of 0.12 to 0.25 ha/h. Whereas the existing automatic potato planters available in the market costs around Rs. 1.2 to 2.5 lakh per unit and they only perform planting operation. The developed planter performs simultaneous planting of tubers and spraying of herbicide, which saves human labour of 20 man-h/ha (costs around Rs. 1125/ha) required for spraying the pre-emergence herbicide application. Planting of cut tubers also saves a seed material of around 500 kg/ha, which costs around Rs. 6000/-.

Keywords: Cut tuber, Coefficient of Variation, Herbicide, Plant emergence, Sensor, Tuber yield.