Nutrient sources and doses for strawberry cultivation: A mini review

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Abstract

Strawberry (Fragaria x ananasa Duch.) is well suited for cultivation under temperate and sub-tropical climatic conditions. However, its successful cultivation is largely influenced by nutrient management. The nutrients application is the function of soil type and climatic conditions which determine the availability of nutrients to the plant and its effective utilization under plant metabolic system. Various researchers have advocated about fertigation treatment and foliar feeding of nutrients to the strawberry plants. Being a shallow rooted crop, the split doses and frequent application of nitrogen, phosphorus and potassium containing fertilizers have been recommended by many researchers. Vegetative growth has largely been influenced by nitrogenous fertilizers while yield and quality are functions of phosphorus and potassium containing fertilizers.

Keywords: Nitrogen, nutrient use efficiency, phosphorus, potassium, strawberry.

Introduction

Strawberry bears attractive, juicy, tasty and nutritious fruits which are well known for distinctive pleasant aroma and gentle flavor. It is a manmade hybrid and is botanically known as Fragaria x ananasa Duch. Strawberry belongs to Rosaceae family with octaploid chromosome number as 56 (2n=8x) and Order Rosales. It is originated from France. It is monoecious, short day, low perennial herb and quick growing fruit plant. It is suitable for kitchen garden. The fruit is rich in vitamin-C and Iron. It is a vital flavor due to Ethyl butanoate and Ethyl hexanoate. Strawberry fruits are also a good source of folic acid.

In India, strawberry is cultivated in the hills and plains of Jammu, Himachal Pradesh, Utter Pradesh, Maharashtra, West Bengal, Delhi, Haryana, Punjab and Rajasthan. Total area is 0.21 thousand ha. And production is 1.61 thousand MT in India during the year 2013-2014 (NHB database 2014). In world, strawberry covers 9.2 lakh hectare area (73 countries) and annual production of strawberry is estimate 45.9 lakh hectare.

Vegetative attributes of strawberry

Strawberry is a perennial herb which spreads by stolons and runner. Leaves of strawberry fruit have 3 leaflets which arise from the crown of the plant. Leaves of strawberry plant are blunt, thick and toothed, the color of flower is white and born in small clusters. Strawberry fruit is small sized aggregate fruit and light to deep red in color, flesh of fruit is soft with pleasant aroma. The plants are hermaphrodite or unisexual. Seed of strawberry is
known as achenes. Succulent thalamus is an edible portion of strawberry. Type of inflorescence is Dichotomic raceme and type of fruit is Etaerio of achenes. Strawberry can be both self and cross pollinated.

Runner is a specialized stem which develops from axle of leaf at the crown of the plants, grows horizontally along the ground to form the new plant at one of the nodes. The runner production favored by long day and high temperature. The daughter plants are separated and used as new planting materials. The runners are mainly propagated in summer through one-year old plants. In hills transplanting is done in March –April and September – October while in plains, suitable time is January –February. Strawberry has wide range of cultivars which can be grown under temperate as well as sub-tropical climate. Soil suitable for strawberry cultivation is well-drained, high in organic matter, sandy loam to loam soil, slightly acidic for root formation with 5.7 to 6.5 pH. Strawberry being a shallow rooted plant require light but more frequent irrigation. First two months it should be irrigated twice per week without rain, in third month it should be weekly while fourth months onwards it is at every two weeks while at the time of fruiting the irrigation frequency can be increased again for larger fruit.

**Role of nutrients and their management in strawberry**

Nitrogen, Phosphorus and Potassium are very important constituents for growth and development of plants. Nitrogen constitutes nucleoproteins, amino acids, amines, amino sugars and many other organic compounds in the plant system. Phosphorus, being a constituent of various nucleoproteins, enzymes and lipids, plays a vital role in the formation of new cells and promotion of root growth. Potassium plays an important role in photosynthesis and helps in the building-up of carbohydrates and their supply in the plant system. Potassium acts as an activator for a number of complex enzyme systems. It also plays a significant role in the transpiration, respiration, water conductance in the plant cell and encourages root division and many other developmental processes in plants.

Joolka *et al.* (1986) studied the performance of strawberry cv. Tioga with application of N at 50-200 kg/ha (half in September and half in 8 February) and P$_2$O$_5$ at 50-100kg/ha in September and basal dressing of 50 kg K$_2$O/ha, during September and recorded the highest yield 8.86 kg/3x2m plot. Mcarthur and Eaton (1987) observed that biweekly applications of 20N-4.3P-8.3K fertilizer in 180 mg/19cm sized pots increased leaf area as compared to 45mg/19cm sized pots and the control. The average fruit weight (9.1g) was recorded with 150 kg N + 75 kg P$_2$O$_5$/ha. Albrgts and Howard (1988) compared soil and foliar applications of NPK in strawberry cvs. Dover and Tufts. The NPK basal application (100:10:83 or 200:20:166 lbs/acre) and foliar application (1.07:0.48:0.9 or 2.14:0.96:1.82 lbs/acre) had pronounced effect on growth of the strawberry plants. Soil applications gave better results than foliar treatments because of leaf injury. Reckruhm and Dluhosch (1988) in a two-year study observed that the first-year application of fertilizer only increased the number of flowers and fruits per plant as compared to the control.

Zhu *et al.* (1989) worked the optimum ratio of N:P:K as 1.2:26:0.74 and the optimum rates (per hectare) were 51kg of N, 64.5kg of P$_2$O$_5$ and 37.5kg of K$_2$O for hilly areas of Jurong county, Jiangsu. Roux *et al.* (1989)
conducted a trial on micro propagated strawberry cv. Brighton planted on peat blocks and concluded that application of the slow release fertilizer osmocote at 28 days (hardening period) increased the growth of young plants. Mamichev and Lyashenko (1989) compared different fertilizer variants of strawberry cv. Amulet and reported that organic fertilizers (100 t/ha) before planting resulted in better growth in comparison with mineral fertilizers and the control. Spring and after harvest application of NPK (60: 60: 60: kg/ha each application) also gave better results than the control. However, all the variants were found to be better than the control in terms of leaf area and dry matter contents.

Kotze et al. (1990) applied NPK at the rate of 0, 3.65 or 7.3 kg/ha on Selekt (each on 25 April, 7 and 23 May, 06 and 20 June) cultivar. In another set of experiments, they applied N on other dates (4 and 31 July, 1 and 22 September and 27 October) totaling 0 and 3.5 kg N/ha as ammonium nitrate solution, respectively. They observed increase in the total marketable yield with autumn application which increased from 21 to 30 t/ha and with spring application to 41 t/ha and with autumn + spring application 45 t/ha. Further, increase in N from 54.73 kg/ha to 73 kg/ha did not enhance yield. The K-rates had little effect on yield. There was, however, decline in yield by the application with the combined K and N at higher doses, a decline by 6 percent at the higher K-rate was observed. Nes and Hjeltness (1992) studied the performance of young strawberry plants on peat blocks supplied with NPK mixture (15-4-12) @ 30 kg/ha before planting. They observed that fertilizer treatments had no effect on runner production and total berry yield but the extra N application increased berry size significantly. Castellane et al. (1993) received the highest fruit yield (36.61 t/ha) with cv. Compinas with application of N at 900 kg/ha + 348 kg K2O/ha over control (27.05 t/ha). Kapanski and Kawscki (1994) studied the effect of N (30, 60, 60 kg/ha) plus FYM (40t/ha) on strawberry cvs. Dukat and Senga Sengana and observed that high rates of N applied annually with FYM had a beneficial effect on leaf number and plant height. They had also recorded the highest yield 20.35 t/ha (averaged for 3 years) with 40t FYM/ha + 30 kg N/ha applied in equal split doses in spring and autumn. However, high N rates (90kg/ha) depressed the yield.

Kreusel and Lenz (1997) reported from a pot experiment that plants treated with 1g N/plant gave the best result. Treatment with higher concentration (1.5g N/plant) caused a slight depression in leaf size and root growth. Lamare and Lareau (1997) fertigated strawberry cv. Tribute with N at 50 or 100 kg/ha, K at 0, 60, 120 or 180 kg/ha and Mg at 0, 25, 50 kg/ha from June to September, for a period of three years and observed that none of the treatments (N or K or Mg) had significant effect on yield. Deng and Woodward (1998) observed that nitrogen deficiency as detrimental factor for growth of plants and had significantly lowered the fruit yield up to 50% by decreasing the number and size of fruits and minimizing fruit set percent. Kreusel and Lenze (1998) recorded decreased yield with an increase in N-rate from 40 to 80 kg/ha applied as an ammonia-depot. Rauf et al. (1998) recorded the maximum fruit weight and a greater number of fruits per pant (6.50g and 4.5 numbers, respectively) with 4g NPK fertilizer per plant in cv. Gorel.
Tagliavini et al. (2005) through their experimentation on nutrient dynamics in strawberry calculated that total nutrients removal by fertilized plants ranged between 78 and 91 kg N, 12 and 17 kg P, 92 and 125 kg K on hectare basis. They have further concluded the significant increase in plant biomass and nitrogen content as a function of nitrogen supply; however, there was no any impact on yield and quality of strawberry fruits. According to Yadav et al. (2009), it was essential to supply the nutrient in appropriate quantity to ensure high production and good quality fruits. They had emphasized on substitution of inorganic sources by organic sources specially that of biological origin which has potential to lower the input cost and without impairing the yield and fruit quality of strawberry crop. They have used combination of organic sources (FYM and vermicompost) and inorganic sources (CAN, SSP and MOP) for nutritional management in strawberry and recommended 50 tonnes of FYM in combination with 80 Kg of N, 40 Kg of P₂O₅ and 40 Kg of K₂O per hectare for high yield in strawberry.

Conclusion

Application of nutrients in split doses and from various organic and inorganic sources is the effective way for nutrient management in strawberry for better production and quality fruits.

References


