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Effect of Different N and K Fertigation Levels on Growth Parameters and Yield of Paprika (*Capsicum annum*. L) Under Drip Fertigation Levels

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ABSTRACT

A field experiment was conducted at Water Technology Centre, College farm, Rajendranagar, Hyderabad during rabi, 2014-15 to study the "Paprika (Capsicum annuum.L) response to fertigation levels of nitrogen and potassium". The experiment was conducted with variety Agnirekha in a randomized block design with three replications. The treatments were eleven, viz., soil application of 100 % N and K_2O with drip irrigation (T_1) and with furrow irrigation (T_2); drip Fertigation of 75% N+75%,100 % and 125 % K_2O (T_3, T_4, T_5, respectively); drip fertigation of 100% N +75%, 100% and 125% K_2O (T_6, T_7, T_8 respectively); drip fertigation of 125% N+75%, 100% and 125% K_2O (T_9,T_{10},T_{11} respectively). The 100% N and K levels were 250 N and 150 K_2O, kg ha^{-1}. Basal dose of 100 kg P_2O_5 ha^{-1} through single super phosphate was applied to all the treatments by soil application. N and K fertilizers for T_1 and T_2 were applied to soil in three equal splits at 10, 35 and 60 DAT and N and K fertigation was in 38 splits through urea and potassium nitrate. Drip irrigation was scheduled (T_1 to T_{11}, except T_2) once in 2 days based on daily data of USWB class 'A' pan evaporimeter and furrow irrigation (T_2) was at 1.0 IW/CPE ratio with 60 mm irrigation depth in furrows in between paired rows (80 cm/40 cm). The amount of total irrigation water applied was 6381 m^3 and 7483 m^3 in drip irrigation and furrow irrigation treatments respectively. The data on total fresh fruit yield (six pickings) (kg ha^{-1}), growth parameters of chilli different growth stages were recorded.

Key words: *Paprika (Capsicum annum. L.), Drip fertigation, Pan evaporimeter, Effective rainfall, Growth parameters and Yield.*

INTRODUCTION

Water and fertilizer are the two important inputs in agriculture and becoming scarce and costly over years. Their efficient use is basic for the survival of agriculture, due to shrinking land: man and water: man ratios, increasing fertilizer prices, hunting energy crisis, wide spread pollution and fast degradation of natural resources. Therefore, there is a need for technological options, which will help in sustaining the precious resources and maximizing crop production with least detrimental impact on the environment.

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The sustainability of any production system requires optimum utilization of resources like water, fertilizer or soil. Efficient use of water and fertilizers is highly critical to sustain the agricultural production, more particularly in the context of declining per capita land and water availability, pollution and increasing cost of fertilizers. Fertigation is the application of water and fertilizers simultaneously to the crops only to the wetted root volume where the active roots are concentrated through micro irrigation systems *i.e*, drip, microjets or micro sprinklers. Paprika (*Capsicum annuum L*.) is a less pungent widely used chilli variety and is an important vegetable cum condiment. It is also locally known as *Bajji mirchi*. It is used as an ingredient in a broad variety of dishes throughout the world. It is now gaining more importance in the global market because of its value added products like chilli powder, paste, oleoresin, capsanthin and capsaicin *etc*. India is a major producer, exporter and consumer of chilli with an area of 794 thousand hectares and production of 1304 thousand million tones with a productivity of 1.6 t ha^{-1} (Indian horticultural data base 2013). The world area and production of chilli is around 15 lakh ha and 70 lakh tonne respectively. Drip is the only option to replace the conventional irrigation method to achieve water-use efficiency. It keeps the soil moisture near to field capacity and also increases fertilizer use efficiency by avoiding losses through leaching, volatilization and fixing of nutrient in the soil.

MATERIAL AND METHODS

A field experiment was conducted at Water Technology Centre, College farm, Rajendranagar, Hyderabad during *rabi,* 2014-15 to study the "Paprika (*Capsicum annuum.L*) response to fertigation levels of nitrogen and potassium". The experiment was conducted with variety Agnirekha in a randomized block design with three replications. The treatments were eleven, viz., soil application of 100 % N and K_2O with drip irrigation (T_1) and with furrow irrigation (T_2);drip Fertigation of 75% N+75%,100 % and 125 % K_2O (T_3, T_4, T_5, respectively); drip fertigation of 100% N +75%, 100% and 125% K_2O (T_6, T_7, T_8 respectively); drip fertigation of 125% N+75%, 100% and 125% K_2O (T_9,T_{10},T_{11} respectively). The 100% N and K levels were 250 N and 150 K_2O, kg ha^{-1}. Basal dose of 100 kg P_2O_5 ha^{-1} through single super phosphate was applied to all the treatments by soil application. N and K fertilizers for T_1 and T_2 were applied to soil in three equal splits at 10, 35 and 60 DAT and N and K fertigation was in 38 splits through urea and potassium nitrate (six, four, four and 24 splits during vegetative stage *i.e* 12-32 DAT, flowering to fruit initiation stage *i.e* 35-46 DAT, fruit initiation to first picking *i.e* 49-60 DAT and first picking on wards from 63-143 DAT respectively) twice in a week at the rate of 18%, 14%, 20% and 48% of N and 14%, 16%, 22% and 48% of K_2O during these four growth stages, respectively. Drip irrigation was scheduled (T_1 to T_{11}, except T_2) once in 2 days based on daily data of USWB class 'A' pan evaporimeter and furrow irrigation (T_2) was at 1.0 IW/CPE ratio with 60 mm irrigation depth in furrows in between paired rows (80 cm/40 cm).

The experimental soil was sandy loam in texture, slightly alkaline in reaction, non saline, low in available nitrogen, high in organic carbon, available phosphorus and potassium. The weekly mean relative humidity ranged from 47.6 % to 88.1 % with a overall mean of 64.4%. The number of sunshine hour's day^{-1} ranged from 3.3 to 9.9 hours with a mean of 6.8 hours day^{-1}. The wind speed varied from 1.0 km to 12.1 km $hour^{-1}$ with a mean of 6.8 hours day^{-1}. The E pan data varied from 2.0 to 5.6 mm with a mean of 3.8 mm. The total amount of rain fall during the crop growth period including nursery period was 324.5 mm, received in 21 days. The total E pan data during the crop growth period including nursery period was 742.7 mm.

The paprika variety Agnirekha from the company Syngenta was as variety crop. Plants of this variety are vigorous, 60-100 cm height with strong lateral branches. The fruit**s** are medium long, thick walled and uniform.

Bearing is solitary. Average fruit length is 10-11 cm and around 1.5 cm in diameter.

NURSERY

The seeds having 70 per cent germination was dibbled in lines on raised beds in the nursery. Before sowing, the nursery area was ploughed with tractor drawn cultivator till fine tilth was obtained. After completion of land preparation, nursery beds of 15 numbers were prepared. The total number of beds was 15. Each bed area was 1.8 m^2 (length= 2.0 m, width = 0.9 m). Total area of nursery beds was 27 m^2. Each bed received 250 g of neem cake, 0.5 kg of vermicompost, 3.5 kg of FYM and nearly 25 kg of red soil. After wards, all the beds were thoroughly drenched with copper oxy chloride (COC) @ (3 g L^{-1}). A day after nursery sowing was done after treating the seeds with acephate @ 1 g per 10 g seed. In each bed, width wise, ten rows were maintained. Eighty grams of seed was used. Approximately, 1300 seed were present in each ten grams seed pack. After sowing, all beds were covered with dried rice straw for a period of five days till germination was obtained.

Main field preparation and manures application:

After collection of the initial soil samples, the main field was thoroughly ploughed thrice and leveled. The field received powdered neem cake @ 460 kg ha^{-1} mixed with *Trichoderma viridi* @ 3 kg ha^{-1} which was mixed in the field and leveling of the individual treatment plots was done. The drip lines were arranged for all the treatment plots and the drip system was checked for its flow rate. Every plot had five drip line laterals. The lateral spacing was 1.2 m. The flow rate was 2 lps (liters per second). A day before planting entire field was thoroughly wetted by using the drip irrigation system.

Transplanting:

After pulling the 35 days old seedlings from nursery, they were dipped in a slurry prepared by mixing 0.5 kg *Trichoderma viridi* and 0.5 kg *Azospirillum* for one hour. Then they were transplanted on 6th September, 2014, adopting a spacing of 80 cm between the rows and 40 cm between plants (paired row). The plot size was 6 m x 7.2 m. In each plot, ten rows were made. Every row had 16 plants. Thus in total 160 plants per each treatment plot were maintained. Gap filling was done one week after transplanting with the reserved nursery.

RESULTS AND DISCUSSION

1. Plant height (cm)

The data on plant height of paprika at 30, 60, 90, 120 and 160 DAT is presented in Table 1. The plant height of paprika was significantly influenced by the treatments. It was observed that the plant height of paprika continued to increase from 30 DAT, to 160 DAT.

The range of plant height at 30 DAT was from 18.43 to 23.37 cm. The highest plant height was recorded with drip fertigation of 125 % N and K (T_{11}) which was significantly higher over soil application of N and K treatments (T_1 and T_2) and fertigation at 75 % N and K (T_3) and on par with all other fertigation treatments. During this early crop growth stage, not much difference among different N and K fertigation levels was noticed. Fertigation with 100 % N and K (T_7) has recorded 17.64 % higher plant height compared to soil application of 100 % N and K and drip irrigation (T_1). Drip irrigation (T_1) has recorded 3.63 % increase in plant height compared to furrow irrigation treatment (T_2).

The plant height at 60 DAT ranged from 58.87 cm to 68.13 cm and followed the same trend as indicated at 30 DAT. Drip fertigation of 125 % and 100 % N at different levels of K (75 to 125 %) has resulted in on par plant height of paprika. Lower plant heights were recorded at 75 % N levels (T_3 to T_5) which increased slightly (62.55 cm to 63.95 cm) with increase in K levels from 75 to 125 % levels. The significantly lowest plant height was recorded with 100 % N and K applied to soil and irrigated by furrow method which was 5.38 % lower than drip irrigation with 100 % N and K levels (62.04 cm). Fertigation of 100 % N and K (T_7) (66.42 cm) resulted in 7.05 % increase in plant height compared to application of same N and K levels to soil and irrigated by drip method.

AT 90 DAT, plant height ranged from 78.21 to 88.08 cm and drip fertigation of 125 % N and K (T_{11}) recorded the highest plant height and was on par with 125 % N with other K levels (T_{10} and T_9) and 100 % N with 125 % K (T_8). These treatments were followed by 100 % N with 100 % and 75 % K levels and 75 % N levels with 125 % and 100 % N levels. The lowest was recorded in 100 % N and K applied to soil with furrow irrigation (T_2) which was on par but 2.74 % lower than drip irrigated treatment (T_1). Application of 100 % N and K by fertigation (T_7) has resulted in 5.47 % increase in plant height (84.76 cm) compared to soil application of same levels with drip irrigation (T_1) (80.36 cm). The T_1 treatment (soil application of 100 % N and K with drip) was on par with fertigation of 75 % N and K levels (T_3) (81.40 cm).

Plant height ranged from 90.57 cm to 101.99 cm at 120 DAT. The highest plant height was recorded with drip fertigation of 125 % N and K level (T_{11}) and was on par in 125 % N + 100 % K (T_{10}) and were significantly superior than all other treatments. It was followed by 125 % N + 75 % N (T_9), T_8 (100 % N + 125 % K) and T_7 (100 % N and K) which were on par among themselves. Lower plant height was recorded in soil applied treatments (T_1 and T_2) which were on par with fertigation at lower N levels i.e. at 75 % N level with 75 % to 125 % K levels (T_3 to T_5). Fertigation of 100 % N and K (T_7) has recorded 7.16 % higher plant height (97.27 cm) over soil application of same N and K levels with drip irrigation (T_1) (90.77 cm).

Plant height ranged from 107.23 to 114.064 cm at 160 DAT. The highest plant height was recorded at fertigation of 125 % N and K level (T_{11}) and was on par with 125 % N with 100 % and 75 % K (T_{10} and T_9), 100 % N with 125 % and 100 % K (T_8 and T_7) and was significantly higher over other treatments. Lower plant heights were recorded in soil applied treatments (T_1 and T_2) which were on par with fertigation at lower N levels i.e. at 75 % N level with 75 % to 125 % K levels (T_3 to T_5) and 100 % N with 75 % K level (T_6). Fertigation of 100 % N and K (T_7) (110.37 cm) has recorded 3 % higher plant height compared to soil application of same N and K levels with drip irrigation (T_1) (108.10 cm).

Plant height is a function of genetic as well as environmental conditions[2]. As the plant height increases, new nodes for flower and fruit development will appear and ultimately results in increase in number of fruits and total yield. Plants reached 70 – 80% of their total height in the first 60 days growth, being tallest with the highest N rate was reported by Chailloux *et al.*[5]. In the present study, in general the highest level of N and K (125 % N and 125% K) applied by fertigation has resulted in the highest height in paprika at all the crop growth stages studied which was on par with lower levels of K. Since nitrogen increase the vegetative growth of the plants[3]; thus plant height increased with incremental increase in nitrogen. Hasan[9] observed no significant increase in plant height of chillies with increasing potash levels. Sankar *et al.*[18] reported to resulted in triggering the production of plant growth hormone, *viz*. indole acetic acid (IAA) and higher number of leaves throughout the cropping period.

Increase in plant height under drip irrigation and fertigation might have been resulted due to better water utilization and higher nutrient uptake. Similarly drip irrigation at 100% ET noticed 33.1% saving of irrigation water in comparison with surface irrigation method[20]. Bhuvaneswari *et al.*[4] reported enhanced plant height could be due to higher availability of N and their uptake that progressively enhanced that plant height. Similar results were reported by Abayomi *et al.*[1], Abid Khan *et al.*[2], Edna Antony *et al.*[7], Khan *et al.*[11], Nisar Naeem[14], The highest increase in vegetative growth might be due to the availability of soil moisture as well as temperature at optimum level[17].

2. Number of branches plant^{-1}

The data on number of branches plant^{-1} of paprika at 30, 60, 90 and 120 DAT is presented in Table.2. The number of branches of paprika plant^{-1} was significantly influenced by the treatments at 30, 60 and 90 DAS but not at 120 DAT. It was observed that the no. of

branches of paprika continued to increase from 30 DAT to up to 120 DAT.

At 30 DAT, the number of branches ranged from 3.57 to 5.63 plant^{-1} The highest number of branches were recorded at 125 % N with 125 % K (T_{11}) which was on par with 125 % N with 100 % or 75 % K (T_{10} and T_9) and significantly higher over all other treatments. The treatments with 100 % N along with different levels of K (75 to 125 %) (T_8, T_7 and T_6) and 75 % N + 125 % K (T_5) were on par among themselves. The lowest was recorded with 100 % N and K applied to soil along with furrow irrigation and it was on par with drip irrigation treatment (T_1) and fertigation of 75 % N and K (T_3). Fertigation of 100 % N and K (T_7) has recorded 17.63 % increase in number of branches plant^{-1} compared to soil application of same N and K levels with drip irrigation.

At 60 DAT, it ranged from 4.92 to 5.96 plant^{-1} Drip fertigation of 125 % N with 125 % K (T_{11}) recorded highest number of branches which was on par with 125 % N with 100 % (5.95) or 75 % K (5.82) (T_{10} and T_{11}) and 100 % N + 125 % K (T_8) (5.80) and was significantly higher over other treatments. The fertigation treatments with 100 % N along with 100% and 125 % K (T_7 and T_6) and 75 % N with different K levels (T_3 to T_5) were on par among themselves. The lowest was recorded in T_2 where 100 % N and K were applied to soil along with furrow irrigation and it was on par with drip irrigation treatment (T_1) (5.01). Fertigation of 100 % N and K (T_7) has recorded 11.63 % increase in number of branches plant^{-1} compared to soil application of same N and K levels with drip irrigation. The drip irrigation (T_1) has recorded 3.05 % increase in number of branches plant^{-1} compared to furrow irrigation (T_2) at same level of N&K applied to soil.

At 90 DAT, the number of branches ranged from 4.98 to 7.54 plant^{-1} Number of branches recorded with drip fertigation of 125 % N with 125 % K (T^{11}) was on par with 125 % N with 100 % (6.42) and was significantly superior over other treatments. It was followed by 125 % N with 75 % K (T_9) (6.11) and 100 % N with 125 % K (T_8). The lowest branches recorded was 4.98 with furrow irrigation treatment (T_2) and was on par with drip irrigated treatment soil applied (T_1) (5.02) and fertigation at 75 % N with different levels of K (75 % to 125 %) (T_3 to T_5) Fertigation of 100 % N and K (T_7) has recorded 19.12 % higher in number of branches plant^{-1} than to soil application of same N and K levels with drip irrigation.

The number of branches of paprika at 120 DAT was not significantly influenced by treatments. However it followed the trend as that of 90 DAT. It ranged from 6.54 to 8.19 plant^{-1} in different treatments The highest was noticed in fertigaon T_{11} (8.19) and the least in N & K applied to soil T_2 (6.54) with furrow irrigation.

Nitrogen has a significant effect on number of branches plant^{-1} as it activates vegetative growth[2,14]. These results agree with the findings of Manichanda and Singh[12]. Similarly, a linear increase in the number of branches plant^{-1} in chillies with increase in nitrogen levels was also noticed by Khan and Suryanarayana[10], Khan *et al.*,[11] and Paul *et al.*, [17]. Higher vegetative growth in treatments with drip irrigation and higher dose of nitrogen might be due to the availability of soil moisture and nutrients. Similar result was reported by Tiwari *et al.*[19] who attributed for higher branches was maintenance of optimum temperature in soil due to drip irrigation than furrow irrigation. Gupta *et al.*[8] in paprika, reported that higher doses of N and K markedly increased the branch production under drip irrigation and fertigation which might be due to sufficient to potential growth and development. steady supply of essential nutrients to the crop, moisture and favourable soil physical environment there by higher nutrient which promoted the auxiliary buds in to new shoots. Similar uptake results were reported earlier by Malawadi[13] and Patil *et al.*[15].

3. Number of leaves plant^{-1}

Data on no. of leaves plant^{-1} at 30, 60, 90 and 120 DAT is presented in Table 3. The no. of leaves was significantly influenced by the treatments at all the stages recorded. In general, the maximum no. of leaves was noticed at 60 DAT.

At 30 DAT, it ranged from 38.57 to 84.87 plant^{-1}. The highest number of leaves plant^{-1} were noticed with drip fertigation of 125 % N and K (T_{11}) which was on par with 125% N with other K levels (T_9 and T_{10}). It was followed by other fertigation treatments with N at different levels (75%, 100% and 150%) in combination with different K levels (75%, 100% and 150%), which were on par among each other. The lowest number of leaves was noticed in soil application of 100% N and K with furrow irrigation (T_2). Application of 100 % N and K by fertigation (T_7) (58.47) has recorded 28.2% of increase in number of leaves plant^{-1} compared to application of same dose to soil with drip irrigation (T_1) (45.60). The increase in number of leaves was 18.2%, when irrigation was given by drip (T_1) compared to furrow irrigation at 100 % N and K applied to soil (T_2).

At 60 DAT, it ranged from 51.70 to142.83 plant^{-1}. Drip fertigation of 125% of N and K (T_{11}) recorded the maximum no. of leaves plant^{-1}which was on par with application of 125% N along with 100% (T_{10}) and 75% K (T_9), and 100% N with 75%, 100% and 125% K levels (T_6 to T_9) and significantly higher than 75% N levels with different K levels and soil application treatments. The lowest no. of leaves were recorded in T_2 (51.70) which was significantly lower than all other treatments. Fertigation of 100% N and K (T_7) (127.43) has recorded 29.85% higher no. of leaves plant^{-1} compared to soil application of 100% N and K with drip irrigation (T_1) (98.13). The drip irrigation has resulted in 89% increase in no. of leaves plant^{-1} compared to furrow irrigation (T_1) at 100 % N and K soil application.

At 90 DAT, it ranged from 52.63 to 86.90 plant^{-1} The highest no. of leaves plant^{-1} were observed in 125% N and K (T_{11}) which was on par with 125% N with 100% K (T_{10}) and 75% N (T_9) and 100% N in combination of 125% (T_8) and 100% K (T_7) and significantly higher over other treatments. Lower no. of leaves were noticed in treatments with 75% N levels in combination with different levels of K and soil application of 100% N and K. Fertigation of 100% N and K (T_7) has recorded 23.35% higher no. of leaves plant^{-1} (74.63) compared to soil application of same level under drip irrigation (T_1) (60.50).

At 120 DAT, It ranged from 67.07 to 87.50 plant^{-1} It followed the same trend as that of 90 DAT. The highest no. of leaves plant^{-1} were noticed with fertigation of 125 % N and K (T_{11}) which was on par with 125% N with 100 % (T_{10}) and 75% K (T_9) and 100 % N with 125%, 100%, and 75% K levels (T6 to T_8) and significantly higher over other treatments. Lower no. of leaves were noticed in treatments with fertigation of 75% N levels in combination of different levels of K and soil application of 100% N and K. Fertigation of 100% N and K (T_7) (72.70) has recorded 4.6% higher no. of leaves plant^{-1} compared to soil application of same level under drip irrigation (T_1) (70.40). At this stage, drip irrigation (T_1) has resulted in 4.96% increase in no. of leaves plant^{-1} compared to furrow irrigation (T_2) at 100 % N and K by soil application. However, statistically these two treatments were on par with each other.

Increase in leaves plant^{-1} could be due to sufficient amount of nitrogen which has provided an ideal environment and balanced nutrition to plants resulted in increased number of leaves. Similar observations were also made by Varalakshmi *et al.*[21], Chauhan *et al.*[6], Leaves have direct relation with number of branches. Plants having more branches gave more leaves and vice versa.[2] and Paul *et al.*[17].

4. Fresh fruit yield (kg ha^{-1})

The data on green fruit yield (sum of five pickings), red fruit yield (6th picking) and total

fresh fruit yield (green + red fruits) are presented in Table 4. The green, red and total fresh fruit yield of paprika was found to be significantly influenced by different N and K fertigation levels imposed.

4.1. Green fruit yield

The total green fruit yield ranged from 7371 to 20663 kg ha^{-1}. Among different combinations of N and K fertigation levels, the highest green fruit yield was recorded by fertigation at 125% N + 75 % K level (T_9) (20,663 kg ha^{-1}) which was on par with 125 % N + 125 % K (19,495 kg ha^{-1}) and significantly higher over all other treatments. It was noticed that even at lower N levels i.e. at 75 % and 100% N also, K level at 75% K was found to be better than 100 % or 125 % K levels. Increase in K level beyond 75 % resulted in decrease in green fruit yield. It was further noticed that 1.67 % increase in green fruit yield was observed when fertilizers were applied through Fertigation (T_7) (14,354 kg ha^{-1}) compared to soil application T_1 (14,117 kg ha^{-1}). The advantage of drip irrigation (T_1) was reflected in recording twice the yield of surface irrigation (T_2). The corresponding yields were 14,117 and 7,371 kg ha^{-1} respectively.

4. 2. Red fruit yield

The red fruit yield ranged from 889 to 6547 kg ha^{-1}. The highest red fruit yield was noticed at 125 % N + 100 % K (T_{10}) fertigation which was on par with 100% N + 125 % K (T_8) and significantly higher over other treatments. Drip fertigation 100 % N with different doses of K ranging from 75 % to 125 % recorded on par red fruit yield. Soil application of fertilizers with drip irrigation (T_1) recorded the significantly lowest red fruits yield. Soil application of 100 % N and K under furrow irrigation (T_2) recorded nearly 2.5 times more red fruits yield compared to drip irrigation. Application of 100 % N and K by fertigation (T_7) recorded nearly 3.68 times more red fruit yield compared to application of same dose of N and K through soil application (T_1).

4. 3. Total fresh fruit yield (green + red fruits) (kg ha^{-1})

The total fresh fruit yield ranged from 9611 to 22,076 kg ha^{-1}. The highest total fresh fruit yield was recorded with drip fertigation of 125 % N + 75% K (T_9) which was on par with 125 % N + 125 % K (T_{11}) (20,822 kg ha^{-1}) and 125 % N + 100 % K (T_{10}) (20,721 kg ha^{-1}). The lowest yield was recorded with soil application of 100 % N and K and furrow irrigation (T_2) (9611) which was on par with fertigation with 75% N + 125 % K (T_5) (12584 kg ha^{-1}). At same level of N, increase in K level from 75 % to 100 or 125 % decrease in total yield was observed indicating 75 % K level was sufficient for the paprika crop under the present experimental soil conditions. However, among N levels, the response was positive up to 125% N. Application of 100 % N and K applied through fertigation (T_7) resulted in 17% increase in yield compared to same level of N and K applied to soil conventionally and irrigation by drip (T_1). The same level of 100 % N and K soil application with drip irrigation treatment (T_1) has recorded 56 % higher total fresh paprika fruit yield (15,005 kg ha^{-1}) compared to soil application of same dose of N and K with furrow method (T_2) irrigation (9611 kg ha^{-1}).

In any crop, the yield could be the result of various growth and yield attributing traits. The aim of any applied research is to maximize the yield. The 125% N has resulted in improved growth vigour of the plant through physiological modifications favourably. Higher amount of nitrogen availability results in promotion of better carbohydrates utilization to form more protoplasm and cells[16]. Application of nutrients by fertigation at frequent intervals during different growth stages leads to its availability readily in the vicinity of the root zone resulting in more efficient utilization of applied nutrients than soil application method.

Table 1: Effect of N and K fertigation on paprika plant height at 30, 60, 90, 120 and 160 DAT (final harvest) during *rabi* 2014-2015

Treatments*		Plant height (cm)				
		30 DAT	60 DAT	90 DAT	120 DAT	160 DAT
T1	Soil application of 100 % N and K + drip irrigation	19.1	62.0	80.4	90.8	108.1
T2	Soil application of 100 % N and K + furrow irrigation	18.4	58.9	78.2	90.6	107.2
T3	Fertigation of 75 % N + 75 % K	19.8	62.6	81.4	90.9	109.7
T4	Fertigation of 75 % N+ 100 % K	21.4	63.3	82.8	91.8	110.1
T5	Fertigaion of 75 % N + 125 % K	22.0	64.0	83.6	93.5	110.1
T6	Fertigation of 100 % N + 75 % K	22.3	66.1	84.1	95.9	110.4
T7	Fertigation of 100 % N+ 100 % K	22.5	66.4	84.8	97.3	111.3
T8	Fertigaion of 100 % N + 125 % K	22.7	67.0	87.0	98.1	112.8
T9	Fertigation of 125 % N + 75 % K	23.1	67.0	87.1	99.9	113.1
T10	Fertigation of 125 % N+ 100 % K	23.2	67.3	87.8	100.0	113.3
T11	Fertigaion of 125 % N + 125 % K	23.4	68.1	88.1	102.0	114.6
	SEm±	1.1	1.2	0.7	0.6	1.1
	C.D (P=0.05)	3.3	3.5	2.1	1.9	3.4

Table 2: Effect of N and K fertigation on paprika number of branches plant^{-1} at 30, 60, 90, 120 DAT during *rabi* 2014-2015

Treatments*		Number of branches plant^{-1}			
		30 DAT	60 DAT	90 DAT	120 DAT
T1	Soil application of 100 % N and K + drip irrigation	3.63	5.07	5.02	7.10
T2	Soil application of 100 % N and K + furrow irrigation	3.57	4.92	4.98	6.54
T3	Fertigation of 75 % N + 75 % K	3.73	5.32	5.35	7.14
T4	Fertigation of 75 % N+ 100 % K	3.97	5.40	5.56	7.39
T5	Fertigaion of 75 % N + 125 % K	4.07	5.43	5.66	7.61
T6	Fertigation of 100 % N + 75 % K	4.13	5.45	5.88	7.67
T7	Fertigation of 100 % N+ 100 % K	4.27	5.66	5.98	7.69
T8	Fertigaion of 100 % N + 125 % K	4.47	5.80	6.08	8.18
T9	Fertigation of 125 % N + 75 % K	5.43	5.82	6.11	8.18
T10	Fertigation of 125 % N+ 100 % K	5.47	5.95	6.42	8.18
T11	Fertigaion of 125 % N + 125 % K	5.63	5.96	7.54	8.19
	SEm±	0.30	0.12	0.26	0.45
	C.D (P=0.05)	0.89	0.35	0.77	NS

*75 % N = 187.5 kg N ha^{-1}, 100 % N = 250 kg N ha^{-1}, 125 % N = 312.5 kg N ha^{-1},
75 % K = 112.5 kg K_2O ha^{-1}, 100 % K = 150 kg K_2O ha^{-1}, 125 % K = 187.5 kg K_2O ha^{-1},

Table 3: Effect of N and K fertigation on paprika number of leaves plant^{-1} at 30, 60, 90, 120 DAT during *rabi*, 2014-2015

Treatments*		Number of leaves plant^{-1}			
		30 DAT	60 DAT	90 DAT	120 DAT
T1	Soil application of 100 % N and K + drip irrigation	45.6	98.1	60.5	70.4
T2	Soil application of 100 % N and K + furrow irrigation	38.6	51.7	58.2	67.1
T3	Fertigation of 75 % N + 75 % K	52.2	101.9	52.6	71.9
T4	Fertigation of 75 % N+ 100 % K	53.3	104.2	68.0	71.5
T5	Fertigaion of 75 % N + 125 % K	55.7	107.1	63.8	72.0
T6	Fertigation of 100 % N + 75 % K	58.1	125.4	71.7	72.7
T7	Fertigation of 100 % N+ 100 % K	58.5	127.4	74.6	73.7
T8	Fertigaion of 100 % N + 125 % K	61.5	127.6	76.7	74.5
T9	Fertigation of 125 % N + 75 % K	84.8	142.4	86.1	86.4
T10	Fertigation of 125 % N+ 100 % K	84.5	142.8	86.3	87.1
T11	Fertigaion of 125 % N + 125 % K	84.9	142.8	86.9	87.5
	SEm±	3.6	7.2	4.7	5.0
	C.D (P=0.05)	10.6	21.1	13.8	14.8

Table 4: Effect of N and K fertigation on paprika total fresh fruit yield (five pickings) red fruit yield (6th picking), total fresh fruit yield (green + red) (kg ha^{-1}) during *rabi* 2014-2015

Treatments*		Green fruit yield	Red fruit yield	Total fruit yield
T1	Soil application of 100 % N and K + drip irrigation	14117	889	15005
T2	Soil application of 100 % N and K + furrow irrigation	7371	2240	9611
T3	Fertigation of 75 % N + 75 % K	16937	1313	18250
T4	Fertigation of 75 % N+ 100 % K	13251	3937	17188
T5	Fertigaion of 75 % N + 125 % K	10710	1873	12584
T6	Fertigation of 100 % N + 75 % K	14262	3866	18128
T7	Fertigation of 100 % N+ 100 % K	14354	3276	17630
T8	Fertigaion of 100 % N + 125 % K	12950	4239	17189
T9	Fertigation of 125 % N + 75 % K	20663	1413	22076
T10	Fertigation of 125 % N+ 100 % K	14174	6547	20721
T11	Fertigaion of 125 % N + 125 % K	19495	1326	20822
	SEm±	863	891	1279
	C.D (P=0.05)	2546	2630	3772

*****75 % N = 187.5 kg N ha^{-1}, 100 % N = 250 kg N ha^{-1}, 125 % N = 312.5 kg N ha^{-1},
75 % K = 112.5 kg K_2O ha^{-1}, 100 % K = 150 kg K_2O ha^{-1}, 125 % K = 187.5 kg K_2O ha^{-1},

CONCLUSIONS

The result of the present study revealed that the plant height, number of branches and number of leaves, yield at different pickings of chilli were enhanced by the combined effect of drip fertigation at N and K up to 125%+75% level (312.5-112.5 kg N - K_2O ha^{-1}), applied in 38 splits at weekly interval to paprika from emergence to fruit maturing stage. Among the methods of irrigation tested, drip was found to be more suitable for paprika cultivation followed by furrow method of irrigation. Taking in to consideration of economics, it is suggested to eliminate phosphorus from fertigation programme and go for fertigation of only N and K up to 125% through urea and potassium nitrate and better to go for soil application of phosphorus fertilizer as single basal dose to make the fertigation programme of paprika as more economically viable.

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