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# Effect of drip fertigation levels on nutrient uptake and post-harvest available nutriment status of *adsali* sugarcane

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**Abstract**
A field experiment was conducted during 2019-20 and 2020-21 at Agricultural Research Station, Hukkeri (Dist. Belagavi, Karnataka) to evaluate the performance of *adsali* sugarcane under varied levels of drip fertigation. Experiment was laid in strip block design with three drip irrigation levels as vertical strip and three fertigation levels as horizontal strip along with two control treatments *i.e.,* surface irrigation as per recommended package of practice and farmers' practice under drip irrigation. Irrigation treatments included drip irrigation at 0.6 $ET_o$ at germination + 0.85 $ET_o$ at tillering + 1.0 $ET_o$ at canopy establishment + 1.15 $ET_o$ at grand growth + 0.85 $ET_o$ at maturity stage ($I_1$), drip irrigation at 0.6 $ET_o$ at germination + 1.0 $ET_o$ at tillering + 1.5 $ET_o$ at canopy establishment + 1.5 $ET_o$ at grand growth + 0.85 $ET_o$ at maturity stage ($I_2$) and drip irrigation at 0.8 $ET_o$ at germination+ 1.0 $ET_o$ at tillering + 1.75 $ET_o$ at canopy establishment + 2.0 $ET_o$ at grand growth +1.0 $ET_o$ at maturity stage ($I_3$). Fertigation levels were *viz.,* 100 per cent RDF (Recommended dose of fertilizer) ($F_1$), 150 per cent RDF ($F_2$) and 200 per cent RDF ($F_3$) along with two control treatments *i.e.,* RPP and farmers' practice. DI at 0.8 $ET_o$ at germination + 1.0 $ET_o$ at tillering + 1.75 $ET_o$ at canopy establishment + 2.0 $ET_o$ at grand growth +1.0 $ET_o$ at maturity stage along with 150 per cent RDF through fertigation ($I_3F_2$) recorded significantly higher nutrient uptake (629.4, 96.5 and 552.4 kg N, P and K $ha^{-1}$, respectively) at harvest. Drip fertigation treatments recorded significantly higher nutrient uptake over the control treatments. Enhancement in the nutrient uptake was to the tune of 18.9, 24.9 and 21.4 per cent more N, P and K, respectively compared to RPP and 24.7,25.1 and 21.6 per cent more N, P and K, respectively compared to farmers' practice.

**Keywords:** Drip irrigation, fertigation, recommended dose of fertilizer and nutrient uptake

## 1. Introduction
Sugarcane, an old energy source for human beings and, more recently, a replacement of fossil fuel for motor vehicles, was first grown in South East Asia and Western India. Around 327 B.C. it was an important crop in the Indian sub-continent. It was introduced to Egypt around 647 A.D. and, about one century later, to Spain (755 A.D.). India is having the second largest area and production of sugarcane next to Brazil in the world. The world sugarcane area is 26.54 m ha with production of 1861 m t and productivity of 70.13 t $ha^{-1}$. In India, the area is 4.6 m ha with production of 370.5 m t and productivity of 80.5 t $ha^{-1}$ (Anon., 2020) [1]. The sugar recovery in the high recovery zone (>10%) like Maharashtra, Gujarat, Karnataka and Madhya Pradesh ranged from 10.64 to 11.42 per cent with an average recovery of 11.05 per cent. Drip fertigation is an efficient means for applying water and nutrients to crops and 10-30 per cent water savings can be realized compared to conventional surface irrigation systems. Therefore, drip irrigation with fertigation can result in optimum sugarcane yield, quality and economic return, without polluting losses of N to ground water (Pier and Doerge, 1995) [6]. Research is needed to determine the effects on the nutrient uptake by the crop and soil nutrient status resulting from drip fertigation system. This paper reports on the results of an experiment to understand the nutrients uptake by cane and the effect of drip fertigation on post harvest nutrient status of the crop.

## 2. Materials and Methods
A field investigation to study the response of sugarcane to drip fertigation was carried out in *adsali* season during 2019-20 and 2020-21. The field experiment was laid out at ARS, Hukkeri, Belagavi, Karnataka in strip block design with three drip irrigation levels as vertical strip and three fertigation levels as horizontal strip along with two control treatments *i.e.,*

surface irrigation as per recommended package of practice and farmers' practice under drip irrigation was based on survey. Drip irrigation levels were *viz.*, DI at 0.6 $ET_o$ at germination + 0.85 $ET_o$ at tillering + 1.0 $ET_o$ at canopy establishment + 1.15 $ET_o$ at grand growth + 0.85 $ET_o$ at maturity stage ($I_1$), DI at 0.6 $ET_o$ at germination + 1.0 $ET_o$ at tillering + 1.5 $ET_o$ at canopy establishment + 1.5 $ET_o$ at grand growth + 0.85 $ET_o$ at maturity stage ($I_2$) and DI at 0.8 $ET_o$ at germination+ 1.0 $ET_o$ at tillering+ 1.75 $ET_o$ at canopy establishment + 2.0 $ET_o$ at grand growth +1.0 $ET_o$ at maturity stage ($I_3$). Fertigation levels were, application of fertilizers at 100 per cent RDF (250:75:190 kg N, $P_2O_5$ and $K_2O$ per ha) ($F_1$), 150 per cent RDF (375:112.5:285 kg N, $P_2O_5$ and $K_2O$ per ha) ($F_2$) and 200 per cent RDF (500:150:380 kg N, $P_2O_5$ and $K_2O$ per ha) ($F_3$). Two control treatments were RPP (250:75:190 kg N, $P_2O_5$ and $K_2O$ per ha under surface irrigation) and farmers' practice (470:172.5:222.5 kg N, $P_2O_5$ and $K_2O$ per ha under drip irrigation). General green manure (sun hemp) crop was grown *in-situ* and incorporation was done before planting of cane followed by application of FYM @ 25 t $ha^{-1}$. Micronutrient *viz.*, $FeSO_4$ and $ZnSO_4$ @ 25 kg $ha^{-1}$ and biofertilizers *viz.*, *Azospirillum* and PSB @ 10 kg $ha^{-1}$each for all treatments were applied. Fertigation was scheduled as follows, in initial 45 days after planting (0-45 DAP) 15:10:10 N, $P_2O_5$ and $K_2O$ per cent of RDF was applied, where 10:10:10 N, $P_2O_5$ and $K_2O$ was basal dose and 5:0:0 N, $P_2O_5$ and $K_2O$ was given through fertigation. From 46-135 DAP,35:35:15 N, $P_2O_5$ and $K_2O$ per cent of RDF was applied through fertigation in equal splits at 15 days interval. Similarly, from 136-225 DAP (50:55:35 N, $P_2O_5$ and $K_2O$ per cent of RDF) and from 226-380 (0:0:40 N, $P_2O_5$ and $K_2O$ per cent of RDF) in equal splits were applied. Sugarcane was irrigated as per treatments based on actual evapo-transpiration (AET) from pan data values at four days intervals. Irrigation was done through drip method in control $C_1$ at four days interval throughout the crop growth stage and through surface method of irrigation in $C_2$. In RPP, surface irrigation was gives by following the schedule *i.e.*, during 0 – 45 DAP (once in 7 days), during 46- 225 DAP (once in 10 days), during 226-405 DAP (once in 7 days) and during 406 – 495 DAP (once in 15 days). Drip irrigation was provided for 3 hours in four days interval and during summer months (March, April and May) surface irrigation was given once in 15 days (Based on survey) in farmers' practice treatment. The experimental field was sandy loam in texture which was medium in organic carbon (0.65%). The soil was normal in reaction (pH 8.13), low in available N (248.3 kg $ha^{-1}$), medium in available phosphorus (41.5 kg $ha^{-1}$) and high in available potassium (455.2 kg $ha^{-1}$). A known weight of powdered plant samples was treated with concentrated nitric acid and kept overnight for pre digestion. Next day, the pre-digested samples were treated with di acid mixture ($HNO_3$:$HClO_4$ at 9:4 ratio) and digested on a sand bath at low temperature till colour less white residue was obtained. The residue was dissolved in 6 N HCl and filtered and made to known volume. After digestion, the following analysis was carried out in the di-acid digest.

**Table 1:** Parameter Method employed

| Sl. No. | Parameter | Method employed | Reference |
|---|---|---|---|
| 1 | Total nitrogen content (%) | $H_2SO_4$ digestion followed by kjeldahl distillation (Micro Kjeldahl method) | Tandon, 1998 [9] |
| 2 | Total phosphorus content (%) | Diacid digestion followed by spectrometric determination (yellow colour method) | Tandon, 1998 [9] |
| 3 | Total potassium content (%) | Diacid digestion followed by flame photometric determination | Tandon, 1998 [9] |

**Nutrient uptake**

$$\text{Nutrient uptake (kg ha}^{-1}\text{)} = \frac{\text{Nutrient concentration (\%)} \times \text{Total biomass (kg ha}^{-1}\text{)}}{100}$$

**Soil analysis**

Soil chemical properties *viz.*, Available N, $P_2O_5$ and $K_2O$ at harvest stage of the crop was analysed.

**Table 2:** Methodology adopted for soil analysis

| Parameter | Method employed | Reference |
|---|---|---|
| Available N (kg $ha^{-1}$) | Alkaline permanganate method | Sharawat and Buford, 1982 [7] |
| Available $P_2O_5$ (kg $ha^{-1}$) | Olsen's method | Sparks, 1996 [8] |
| Available $K_2O$ (kg $ha^{-1}$) | Flame photometer method | Sparks, 1996 [8] |

## 3. Results and Discussion

### 3.1 Uptake of major nutrients

#### 3.1.1 At 240 DAP (cf table 1)

There was significant and linear increase in N, P and K uptake from $I_1$ to $I_3$. DI at 0.8 $ET_o$ at germination + 1.0 $ET_o$ at tillering + 1.75 $ET_o$ at canopy establishment + 2.0 $ET_o$ at grand growth +1.0 $ET_o$ at maturity stage ($I_3$) recorded significantly higher nutrient uptake (397.5, 65.3 and 322.3 kg N, P and K $ha^{-1}$, respectively). DI ($I_1$) at 0.6 $ET_o$ at germination + 0.85 $ET_o$ at tillering + 1.0 $ET_o$ at canopy establishment + 1.15 $ET_o$ at grand growth + 0.85 $ET_o$ at maturity stage (306.1, 46.1 and 254.9 kg $ha^{-1}$, receptively) recorded significantly lower nutrient uptake.

Application of fertilizers at 200 per cent RDF ($F_3$) through fertigation (388.9, 62.3 and 316.0 kg N, P and K $ha^{-1}$, respectively) recorded significantly higher nutrient uptake and was on par with 150 per cent RDF ($F_2$) through fertigation (357.5, 55.9 and 293.2 kg $ha^{-1}$, respectively). Similar results were reported by Madake, 2009 [5] and Gaikwad, 2001 [4].

Among the interaction, DI ($I_3F_3$) at 0.8 $ET_o$ at germination + 1.0 $ET_o$ at tillering + 1.75 $ET_o$ at canopy establishment + 2.0 $ET_o$ at grand growth + 1.0 $ET_o$ at maturity stage along with 200 per cent RDF through fertigation recorded significantly higher nutrient uptake 433.4, 70.6 and 352.6 kg N, P and K $ha^{-1}$, respectively) and was on par with DI ($I_3F_2$) at 0.8 $ET_o$ at germination + 1.0 $ET_o$ at tillering + 1.75 $ET_o$ at canopy establishment + 2.0 $ET_o$ at grand growth +1.0 $ET_o$ at maturity stage along with 150 per cent RDF through fertigation (397.9, 65.6 and 324.0 kg $ha^{-1}$, respectively). The concentration and availability of various nutrients in the soil for plant uptake depend on the soil solution phase, which is mainly determined by the soil moisture availability. Most root biomass for sugarcane is found close to the surface and then declines approximately exponentially with depth. Typically, approximately 50 per cent of root biomass occurs in the top 20 cm of soil and 85 per cent in the top 60 cm. The favourable soil moisture availability in the top rhizosphere region by continuous water supply under drip irrigation led to higher availability of nutrients in the soil and thereby increased nutrient uptake by the crop. Besides, nitrogen is capable of increasing root cation exchange capacity which in turn helped the plant to absorb more K from the soil.

RPP recorded higher nutrient uptake (248.5, 35.5 and 207.6 kg N, P and K $ha^{-1}$, respectively) over farmers' practice (247.1, 35.5 and 207.2 kg $ha^{-1}$, respectively) and both were significantly least and on par with interaction $I_1F_1$.

**Table 3:** Nutrient uptake by *adsali* sugarcane as influenced by drip irrigation and fertigation at 240 DAP

| Treatment | | Nutrient uptake at 240 DAP (kg $ha^{-1}$) | | |
|---|---|---|---|---|
| | | N | P | K |
| **Drip irrigation levels (I)** | | | | |
| $I_1$ | DI at 0.6,0.85,1.00,1.15 & 0.85 $ET_o$ at G, T, CE, GG & M stage, respectively | $306.1^{c}$ | $46.1^{c}$ | $254.9^{c}$ |
| $I_2$ | DI at 0.6, 1.00,1.50,1.50 & 0.85 $ET_o$ at G, T, CE, GG & M stage, respectively | $356.1^{b}$ | $55.7^{b}$ | $285.7^{b}$ |
| $I_3$ | DI at 0.8,1.00,1.75, 2.00 &1.00 $ET_o$ at G, T, CE, GG & M stage, respectively | $397.5^{a}$ | $65.3^{a}$ | $322.3^{a}$ |
| | S.Em. ± | 5.81 | 0.88 | 4.74 |
| **Fertigation levels (F)** | | | | |
| $F_1$ | 100% RDF (through fertigation) | $313.3^{b}$ | $48.8^{b}$ | $253.7^{b}$ |
| $F_2$ | 150% RDF (through fertigation) | $357.5^{ab}$ | $55.9^{ab}$ | $293.2^{ab}$ |
| $F_3$ | 200% RDF (through fertigation) | $388.9^{a}$ | $62.3^{a}$ | $316^{a}$ |
| | S.Em. ± | 7.38 | 1.15 | 6.03 |
| **Interaction (IxF)** | | | | |
| $I_1F_1$ | DI at 0.6, 0.85, 1.00, 1.15 & 0.85 $ET_o$ at G, T, CE, GG & M stage, respectively. with 100% RDF | $262.3^{g}$ | $38.3^{e}$ | $221.0^{fg}$ |
| $I_1F_2$ | DI at 0.6, 0.85, 1.00, 1.15 & 0.85 $ET_o$ at G, T, CE, GG & M stage, respectively. with 150% RDF | $317.62^{ef}$ | $48.0^{d}$ | $266.2^{de}$ |
| $I_1F_3$ | DI at 0.6, 0.85, 1.00, 1.15 & 0.85 $ET_o$ at G, T, CE, GG & M stage, respectively. with 200% RDF | $338.4^{d-f}$ | $51.9^{d}$ | $277.3^{de}$ |
| $I_2F_1$ | DI at 0.6, 1.00, 1.50, 1.50 & 0.85 $ET_o$ at G, T, CE, GG & M stage, respectively. with 100% RDF | $316.5^{f}$ | $48.5^{d}$ | $250.0^{ef}$ |
| $I_2F_2$ | DI at 0.6, 1.00, 1.50, 1.50 & 0.85 $ET_o$ at G, T, CE, GG & M stage, respectively. with 150% RDF | $357.0^{c-e}$ | $54.2^{cd}$ | $289.1^{cd}$ |
| $I_2F_3$ | DI at 0.6, 1.00, 1.50, 1.50 & 0.85 $ET_o$ at G, T, CE, GG & M stage, respectively. with 200% RDF | $394.7^{bc}$ | $64.3^{b}$ | $317.9^{bc}$ |
| $I_3F_1$ | DI at 0.8, 1.00, 1.75, 2.00 & 1.00 $ET_o$ at G, T, CE, GG & M stage, respectively. with 100% RDF | $361.2^{b-d}$ | $59.5^{bc}$ | $290.1^{cd}$ |
| $I_3F_2$ | DI at 0.8, 1.00, 1.75, 2.00 & 1.00 $ET_o$ at G, T, CE, GG & M stage, respectively. with 150% RDF | $397.9^{ab}$ | $65.6^{ab}$ | $324.0^{ab}$ |
| $I_3F_3$ | DI at 0.8, 1.00, 1.75, 2.00 & 1.00 $ET_o$ at G, T, CE, GG & M stage, respectively. with 200% RDF | $433.4^{a}$ | $70.6^{a}$ | $352.6^{a}$ |
| $C_1$ | Recommended package of practice - SI | $248.5^{g}$ | $35.5^{e}$ | $207.9^{g}$ |
| $C_2$ | Farmers' practice- DI | $247.1^{g}$ | $35.5^{e}$ | $207.2^{g}$ |
| | S.Em. ± | 12.72 | 1.99 | 10.36 |
| Initial soil (available) value (kg $ha^{-1}$) | | 248.3 (N) | 41.5 ($P_2O_5$) | 455.2 ($K_2O$) |

C- Control, DI-Drip irrigation, $ET_o$-Actual evapotranspiration (mm), G-Germination, T-Tillering, CE-Canopy establishment, GG-Grand growth, M-Maturity,

RDF-Recommended dose of fertilizer (250:75:190 kg N, $P_2O_5$ and $K_2O$ per ha) and SI-Surface irrigation

Means followed by the same letters (s) within a column do not differ significantly by DMRT (P= 0.05)

### 3.1.2 At harvest (cf. Table 2)

DI at 0.8 $ET_o$ at germination + 1.0 $ET_o$ at tillering + 1.75 $ET_o$ at canopy establishment + 2.0 $ET_o$ at grand growth +1.0 $ET_o$ at maturity stage ($I_3$) recorded significantly higher nutrient uptake (589.4, 91.8 and 516.8 kg N, P and K $ha^{-1}$, respectively) compared to DI ($I_1$) at 0.6 $ET_o$ at germination + 0.85 $ET_o$ at tillering + 1.0 $ET_o$ at canopy establishment + 1.15 $ET_o$ at grand growth + 0.85 $ET_o$ at maturity stage (482.0, 77.1 and 427.5 kg $ha^{-1}$, respectively). With increased water application, there was corresponding increase in solubility of nutrients. This has resulted in more uptake of nutrients radially and continuous availability of water in soil increased nutrient availability and thereby uptake, pointed out by Bangar *et al.* (1998) [3].

Application of fertilizers at 150 per cent RDF ($F_2$) through fertigation (553.7, 87.2 and 495.0 kg N, P and K $ha^{-1}$, respectively) recorded significantly higher nutrient uptake and was on par with 200 per cent RDF ($F_3$) through fertigation (550.8, 86.6 and 481.9 kg $ha^{-1}$, respectively). The increased uptake may also be due to split application of nutrients under drip fertigation that resulted in minimal loss of nutrients thereby making them available continuously to the crop (Tumbare *et al.*, 1999) [10]. Fertigation through water soluble fertilizers helped the dissolved nutrients for better distribution along the wetting soil volume.

Among the interaction, DI at 0.8 $ET_o$ at germination + 1.0 $ET_o$ at tillering + 1.75 $ET_o$ at canopy establishment + 2.0 $ET_o$ at grand growth +1.0 $ET_o$ at maturity stage along with 150 per cent RDF through fertigation ($I_3F_2$) recorded significantly higher nutrient uptake (629.4, 96.5 and 552.4 kg N, P and K $ha^{-1}$, respectively) and was on par with DI ($I_3F_3$) at 0.8 $ET_o$ at germination + 1.0 $ET_o$ at tillering + 1.75 $ET_o$ at canopy establishment + 2.0 $ET_o$ at grand growth +1.0 $ET_o$ at maturity stage along with 200 per cent RDF through fertigation (626.6, 94.8 and 537.1 kg $ha^{-1}$, respectively). The better performance of drip fertigation for nutrient uptake may probably be due to the availability of plant nutrients in ample quantum because of solubility of nutrients in the soil in the presence of right quantity of water. These findings are in close conformity to those of Bangar and Chaudhary (2000) [2].

RPP recorded higher nutrient uptake (444.8, 67.1 and 386.8 kg $ha^{-1}$, respectively) over farmers' practice (424.1, 67.0 and 386.2 kg $ha^{-1}$, respectively) and both were significantly least and on par with interaction $I_1F_1$. The optimum moisture has promoted effect on physiological process like cell division and expansion of cell component, turgidity and nutrient uptake that resulted in higher plant growth. Through drip irrigation, fertilizers were applied frequently. Due to these nutrient losses through leaching and vitalization were less and easily available to plant root zone. This ultimately increased plant growth rate. Similarly, application of water through drip maintains soil air ratio in root zone for cane development along with higher uptake of nutrients. This might have improved the dry matter partitioning efficiency. Similarly, due to drip irrigation, water tension remains low and almost constant for entire growth of crop as compared to surface irrigation.

### 3.2 Soil available nutrient status at harvest (cf. Fig.1)

Drip irrigation at 0.6 $ET_o$ at germination + 0.85 $ET_o$ at tillering + 1.0 $ET_o$ at canopy establishment + 1.15 $ET_o$ at grand growth + 0.85 $ET_o$ at maturity stage ($I_1$) recorded significantly higher available nutrient status (247.7, 51.1 and 422.7 kg, N, $P_2O_5$ and $K_2O$ $ha^{-1}$, respectively) and was on par with DI ($I_2$) at 0.6 $ET_o$ at germination + 1.0 $ET_o$ at tillering + 1.5 $ET_o$ at canopy establishment + 1.5 $ET_o$ at grand growth + 0.85 $ET_o$ at maturity stage (230.9, 48.4 and 411.6 kg $ha^{-1}$, respectively). These results can be interpreted by the fact that a lower level of irrigation with low water application reduced the availability of water in the soil solution to translocate the nutrients, which can be witnessed by reduced dry matter and nutrient uptake in the $I_1$. Hence, there was higher post-harvest availability of nutrients.

Application of fertilizers at 200 per cent RDF ($F_3$) through fertigation (252.1, 53.1 and 429.2 kg, N, $P_2O_5$ and $K_2O$ $ha^{-1}$, respectively) recorded significantly higher available nutrients and was on par with 150 per cent RDF ($F_2$) through fertigation (226.2, 46.7 and 405.1 kg $ha^{-1}$, respectively).

DI at 0.6 $ET_o$ at germination + 0.85 $ET_o$ at tillering + 1.0 $ET_o$ at canopy establishment + 1.15 $ET_o$ at grand growth + 0.85 $ET_o$ at maturity stage along with 200 per cent RDF through fertigation ($I_1F_3$) recorded significantly higher available nutrients (261.5, 58.3 and 440.5 kg N, $P_2O_5$ and $K_2O$ $ha^{-1}$, respectively). The reason for higher post-harvest available nutrients in the soil under drip fertigation could be due to the reduction in leaching loss and better movement of nutrients. There was negative correlation between nutrient uptake and the post harvest nutrient status indicating the fact that lower nutrient uptake has led to higher availability of major nutrients in the soil after the harvest. Apart from that, it also indicated that 200 per cent RDF through fertigation was way beyond the crop demand. Lack of availability of moisture for translocation of nutrients to the crop was the main reason for higher post harvest nutrient status.

**Table 4:** Nutrient uptake by *adsali* sugarcane as influenced by drip irrigation and fertigation at harvest

| Treatment | | Nutrient uptake at harvest (kg $ha^{-1}$) | | |
|---|---|---|---|---|
| | | N | P | K |
| **Drip irrigation levels (I)** | | | | |
| $I_1$ | DI at 0.6,0.85,1.00,1.15 & 0.85 $ET_o$ at G, T, CE, GG & M stage, respectively | $482^{b}$ | $77.1^{b}$ | $427.5^{b}$ |
| $I_2$ | DI at 0.6, 1.00,1.50,1.50 & 0.85 $ET_o$ at G, T, CE, GG & M stage, respectively | $515.9^{b}$ | $82.6^{ab}$ | $465.1^{ab}$ |
| $I_3$ | DI at 0.8,1.00,1.75, 2.00 &1.00 $ET_o$ at G, T, CE, GG & M stage, respectively | $589.4^{a}$ | $91.8^{a}$ | $516.8^{a}$ |
| | S.Em. ± | 9.22 | 1.45 | 8.06 |
| **Fertigation levels (F)** | | | | |
| $F_1$ | 100% RDF (through fertigation) | $482.9^{b}$ | $77.8^{b}$ | $432.4^{b}$ |
| $F_2$ | 150% RDF (through fertigation) | $553.7^{a}$ | $87.2^{a}$ | $495^{a}$ |
| $F_3$ | 200% RDF (through fertigation) | $550.8^{a}$ | $86.6^{a}$ | $481.9^{a}$ |
| | S.Em. ± | 11.59 | 1.81 | 10.20 |
| **Interaction (IxF)** | | | | |
| $I_1F_1$ | DI at 0.6, 0.85, 1.00, 1.15 & 0.85 $ET_o$ at G, T, CE, GG & M stage, respectively. with 100% RDF | $454.9^{c-e}$ | $72.1^{cd}$ | $402.9^{d}$ |
| $I_1F_2$ | DI at 0.6, 0.85, 1.00, 1.15 & 0.85 $ET_o$ at G, T, CE, GG & M stage, respectively. with 150% RDF | $498.2^{b-d}$ | $79.3^{bc}$ | $444.3^{cd}$ |
| $I_1F_3$ | DI at 0.6, 0.85, 1.00, 1.15 & 0.85 $ET_o$ at G, T, CE, GG & M stage, respectively. with 200% RDF | $492.9^{b-d}$ | $79.8^{bc}$ | $435.0^{cd}$ |
| $I_2F_1$ | DI at 0.6, 1.00, 1.50, 1.50 & 0.85 $ET_o$ at G, T, CE, GG & M stage, respectively. with 100% RDF | $481.5^{b-e}$ | $77.0^{b-d}$ | $433.4^{cd}$ |
| $I_2F_2$ | DI at 0.6, 1.00, 1.50, 1.50 & 0.85 $ET_o$ at G, T, CE, GG & M stage, respectively. with 150% RDF | $533.5^{b}$ | $85.6^{b}$ | $488.3^{bc}$ |
| $I_2F_3$ | DI at 0.6, 1.00, 1.50, 1.50 & 0.85 $ET_o$ at G, T, CE, GG & M stage, respectively. with 200% RDF | $532.7^{b}$ | $85.0^{b}$ | $473.4^{c}$ |
| $I_3F_1$ | DI at 0.8, 1.00, 1.75, 2.00 & 1.00 $ET_o$ at G, T, CE, GG & M stage, respectively. with 100% RDF | $512.1^{bc}$ | $84.1^{b}$ | $460.9^{c}$ |
| $I_3F_2$ | DI at 0.8, 1.00, 1.75, 2.00 & 1.00 $ET_o$ at G, T, CE, GG & M stage, respectively. with 150% RDF | $629.4^{a}$ | $96.5^{a}$ | $552.4^{a}$ |
| $I_3F_3$ | DI at 0.8, 1.00, 1.75, 2.00 & 1.00 $ET_o$ at G, T, CE, GG & M stage, respectively. with 200% RDF | $626.6^{a}$ | $94.8^{a}$ | $537.1^{ab}$ |
| $C_1$ | Recommended package of practice - SI | $444.8^{de}$ | $67.1^{d}$ | $386.8^{d}$ |
| $C_2$ | Farmers' practice- DI | $424.1^{e}$ | $67.0^{d}$ | $386.2^{d}$ |
| | S.Em. ± | 19.34 | 3.04 | 17.12 |
| Initial soil (available) value (kg $ha^{-1}$) | | 248.3 (N) | 41.5 ($P_2O_5$) | 455.2 ($K_2O$) |

C- Control, DI-Drip irrigation, $ET_o$-Actual evapotranspiration (mm), G-Germination, T-Tillering, CE-Canopy establishment, GG-Grand growth, M-Maturity,

RDF-Recommended dose of fertilizer (250:75:190 kg N, $P_2O_5$ and $K_2O$ per ha) and SI-Surface irrigation

Means followed by the same letters (s) within a column do not differ significantly by DMRT (P= 0.05)

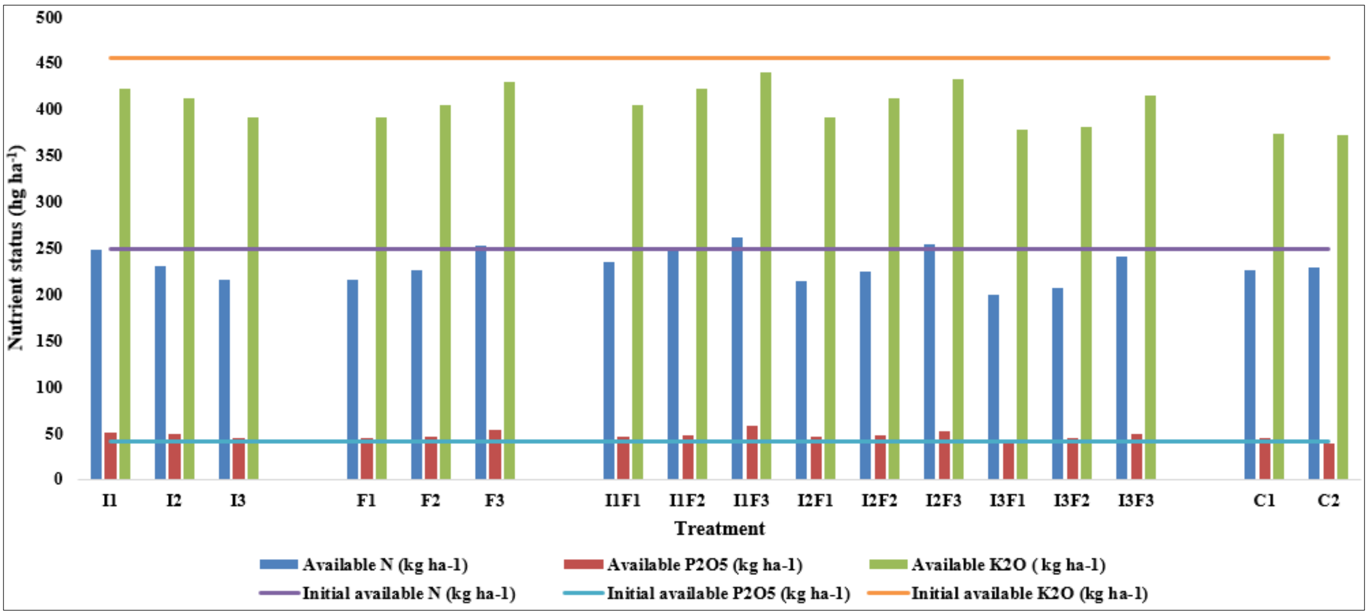


**Fig 1:** Post harvest available nutrient status in *adsali* sugarcane as influenced by drip fertigation levels

## 4. Conclusion

Based on the results of the field experiment, it is concluded that DI at 0.8 $ET_o$ at germination + 1.0 $ET_o$ at tillering + 1.75 $ET_o$ at canopy establishment + 2.0 $ET_o$ at grand growth +1.0 $ET_o$ at maturity stage along with 150 per cent RDF through fertigation ($I_3F_2$) to *adsali* sugarcane recorded significantly higher major nutrients uptake.

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