

## Original Research Article

# Influence of Graded Levels of Potassium Fertigation on Growth of Jalapeno Pepper Grown in Red Bole Soil Under Polyhouse

### ABSTRACT

A field experiment was conducted at Instructional Farm Polyhouse, Dr. Sharadchandra Pawar College of Agriculture, Baramati during June 2023 to September 2023. The study aimed to investigate the Influence of Graded levels of Potassium Fertigation on Growth of Jalapeno Pepper Grown in Red Bole Soil Under Polyhouse. The experiment was laid out in Randomized Block Design (RBD) with four replications. The treatments were five, viz., T<sub>1</sub>- Control, T<sub>2</sub>- Recommended dose of fertilizer, T<sub>3</sub>- Recommended dose of nitrogen and phosphorus (RDNP) + 125% Recommended dose of potassium (RDK), T<sub>4</sub>- Recommended dose of nitrogen and phosphorus (RDNP) + 150% Recommended dose of potassium (RDK) and T<sub>5</sub>- Recommended dose of nitrogen and phosphorus (RDNP) + 175% Recommended dose of potassium (RDK). Data were taken on growth contributing characters and the collected data were statistically analyzed for evaluation of the treatment effects. The plant height, leaf area and chlorophyll content were recorded at 20, 35, 50 and 65 (days after transplanting) which was significantly higher. The maximum plant height (95.65 cm), leaf area (61.61 dm<sup>2</sup>) and chlorophyll content (58.83) were recorded 65 days after transplanting was obtained highest in treatment T<sub>5</sub> i.e. RDNP + 175% RDK. The study revealed that, application of RDNP+ 175% RDK by fertigation from 10 DAT to 60 DAT was found to be optimum for growing of Jalapeno pepper in red bole soil under polyhouse condition.

**Keywords:** Jalapeno Pepper, Fertigation, Potassium, Growth, Days after transplanting

### 1. INTRODUCTION

In many nations across the world chilli pepper (*Capsicum annuum* L.) is now a valuable spice and cash crop making it the third most important crop in the Solanaceae family and was Portuguese introduced in 16<sup>th</sup> century in India. Chilli originated in south and central America. Due to its pungent taste, lustrous green fruits and availability of hot chilli (*Capsicum annuum* L. Solanaceae, 2n = 24) is one of the most preferred spice or taste enhances in the world (Gade *et al.* 2020). Chilli peppers (*Capsicum annuum*) are not just hot flavored fruits of capsicum pepper plants but also good source of vitamins, minerals and antioxidants and most commonly used as a fresh or dried spice. Green chilli fruits provide the following nutritional values per 100 grams: 111 mg vitamin C, 454 I.U. of vitamin A, 0.91% mineral matter and 6.7% fiber. Indian chillies are widely recognized as one of the spiciest vegetables across the globe having high SHU units and are popular among the good enthusiasts. Chilli cultivation is taken majority in tropical and subtropical climatic condition. Around 25 species in the genus capsicum have been identified but only five are domesticated and grown *C. annuum* L, *C. chinense*, *C. frutescens* L, *C. baccatum* Land *C.*

*pubescens*. (Ratna *et al.* 2018). Chilli cultivation is widespread globally, covering an area of about 1.776 million hectares. This extensive cultivation results in a total production of approximately 7.182 million tons of chilli peppers. India is currently the world's largest producer and exporter of chilli peppers. In India, Andhra Pradesh is the leading state in chilli cultivation. It has the maximum area dedicated to growing chillies, covering about 131.3 thousand hectares, which accounts for approximately 16.94% of the total chilli cultivation area in the country.

Jalapeno chilli (*Capsicum annum*) literally meaning from Jalapa got its unique name from the Spanish city which is the capital of Veracruz, a Mexican state where this pepper was first cultivated. Scientific name Jalapeno is *Capsicum annum* which is a species of the plant genus *capsicum*. Jalapenos grow in soil that has a pH of 4.5 to 7. The hotness of Jalapeno peppers will clear sinuses and help to relieve symptoms of colds such as fever and sore throats. The seeds are found in the center of a Jalapeno pepper and are surrounded by a membrane that contains most of the capsaicin in Jalapeno which makes it the most pungent part of the pepper. Potassium has the role in increasing the pigment of the chilli and also affects the pungency. Jalapeno Peppers are rich source of potassium. Jalapeno contains Iron, magnesium, manganese, phosphorus and copper in trace amounts. Potassium plays a pivotal role and facilitates the production of photosynthates and their transport to storage organs of the plant such as fruits in Jalapeno chilli enhancing their conversion into starch, protein, vitamins and oil. While in Jalapeno chilli deficiency of potassium may lead to being arrested rate of photosynthesis and the rate of translocation and enzyme systems.

## **2. MATERIAL AND METHODS**

### **2.1 Geographical Location and Experimental Site**

Baramati city comes under the Pune district of Maharashtra state. It is situated in south east zone at the latitude 18.14 °N and longitude 74.52 °E. The elevation is 563 m above mean sea level. The Instructional farm situated 4 km away from Malegaon village and about 6.8 km away from Baramati tehsil place. The field experiment was conducted at the Instructional farm, Polyhouse, Dr. Sharadchandra Pawar College of Agriculture, Baramati.

### **2.2 Design of Experiment**

The field experiment was conducted in Randomized Block Design (RBD) with 4 replications and 5 treatments in each replication.

### **2.3 Treatment Details**

The experimental details of treatment, which were comprised 5 treatments are presented in Table 1.

**Table. 1: Treatment details**

Tr. No.	Treatments
T <sub>1</sub>	Control
T <sub>2</sub>	RDF– (100:50:50) (N,P <sub>2</sub> O <sub>5</sub> ,K <sub>2</sub> Okg <sup>-1</sup> )
T <sub>3</sub>	RDNP+ 125% RDK
T <sub>4</sub>	RDNP + 150%RDK
T <sub>5</sub>	RDNP + 175% RDK

## 2.4 Transplanting

All the beds were saturated by providing sufficient quantity of water through drip system before transplanting. The four week old healthy and uniform chilli seedlings were transplanted at the spacing of 90 cm x 45 cm on the raised beds. The roots of seedling along with coco peat were placed in soil and slightly pressed for easy establishment of seedling. Placement of plant was zigzag. Each treatment was having twenty-one plants with four replications.

## 2.5 Fertigation

Drip irrigation system was installed for application of water and fertilizer. Fertigation was done through water soluble fertilizers through soil in control throughout the cropping period. water soluble fertilizers were applied at an interval of 10, 30, 45 and 60 days after transplanting.

## 2.6 Cultural Practices

### 2.6.1 Weeding and irrigation

Manual weeding was done whenever weeds were noticed to keep the plots clean. Drip irrigation was resorted for irrigating the plot frequently to maintain the optimum moisture levels in the soil. All the plant protection measures were taken to control pests and diseases as and when necessary, as per package of practice.

### 2.6.2 Staking

The plants were staked with the help of jute thread and tied to a barbed wire 30 days after transplanting to prevent lodging of plants.

## 2.7 Details of Observation

Five plants were selected in each replication as observational plants to record the data on defined characters in research trial.

### 2.7.1 Growth contributing characters

#### 2.7.1.1 Plant height (cm)

The height of plant was recorded in centimeter (cm) at different days after transplanting of crop duration. Data were recorded as the average of 5 plants selected at random from each plot. The height was measured from the ground level to the tip of the plant by meter scale. Data was taken at 20, 35, 50 and 65 DAT.

#### **2.7.1.2 Leaf area (dm<sup>2</sup>)**

Leaf area was recorded by taking leaf from bottom, middle and top portion of the plant using leaf area meter (panomax leaf area meter) at 20, 35, 50 and 65 DAT then average was worked out and expressed in dm<sup>2</sup>.

#### **2.7.1.3 Chlorophyll content**

The leaf chlorophyll content was determined by using a SPAD-502 meter (Konika Minolta, Japan). At vegetative, flowering and harvesting stage fully opened and matured leaves were selected for to check the chlorophyll content middle and bottom portion of leaf inserted in SPAD meter. Record the value of randomly selected five plants in between 9:30 to 10:30 a.m. hour and it is expressed in spad units.

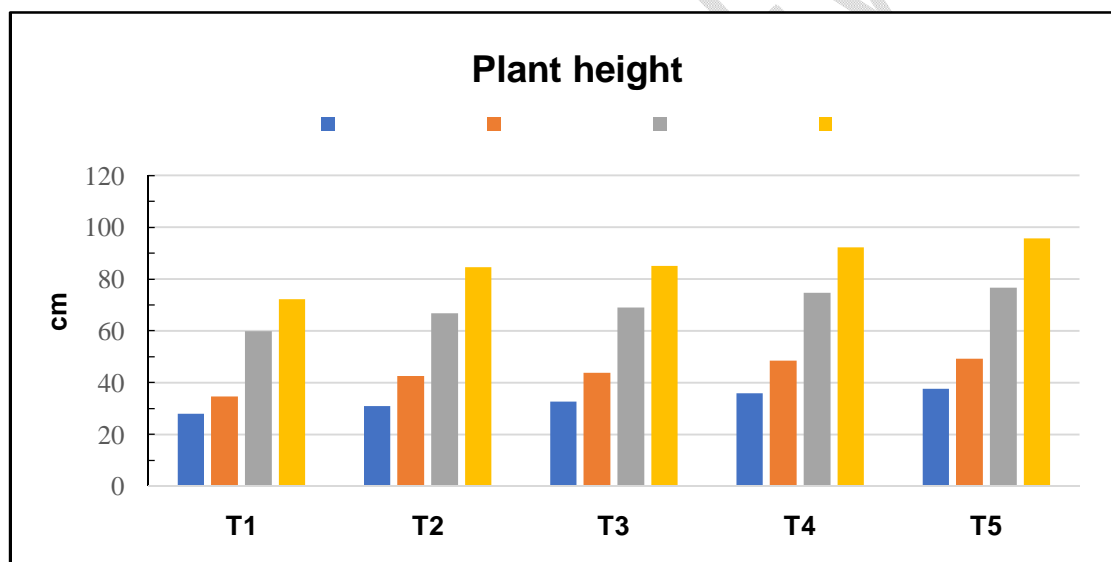
### **3. RESULT AND DISCUSSION**

#### **3.1 Plant height**

The data on plant height of Jalapeno pepper is displayed in Table 2 and fig. 1 showed that application of graded levels of potassium fertigation had a significant effect on plant height at 20, 35, 50 and 65 DAT. The highest plant height of Jalapeno pepper obtained in the treatment applied to RDNP + 175% RDK recorded (37.73 cm), (49.20 cm), (72.65 cm) and (95.65 cm) after 20, 35, 50 and 65 DAT was at par with T<sub>4</sub> treatment. The lowest plant height was observed in control treatment (28.03 cm), (34.53 cm), (59.97 cm) and (72.27 cm) after 20, 35, 50 and 65 DAT. Potassium involved in the process of cell expansion and also promote the strong root system, which in turn support better above-ground growth, including increased plant height. Potassium plays a crucial role in plant metabolism and it is essential for several processes that promote vegetative growth and development according to Bassiony *et al.* (2010). Sabina *et al.* (2023) demonstrated that potassium may increase nitrogen assimilation, resulting to improved plant height and vegetative development. More or less similar finding was reported by Adhikary *et al.* (2006), Bose *et al.* (2006), El-Nemr *et al.* (2012), Bhuvanewari *et al.* (2013), Golcz *et al.* (2015), Hassan *et al.* (2016), Hegazi *et al.* (2017) and Kakar *et al.* (2024).

**Table. 2.**Influence of graded levels of potassium fertigation on plant height of Jalapeno pepper

Tr. no.	Treatment	Plant height (cm)			
		20 DAT	35 DAT	50 DAT	65 DAT
T <sub>1</sub>	Control	28.03	34.53	59.97	72.27
T <sub>2</sub>	RDF– (100:50:50) (N,P <sub>2</sub> O <sub>5</sub> ,K <sub>2</sub> Okg <sup>ha</sup> <sup>-1</sup> )	31.05	42.45	66.75	84.56
T <sub>3</sub>	RDNP+ 125% RDK	32.59	43.75	69.08	85.06
T <sub>4</sub>	RDNP + 150%RDK	35.92	48.54	74.80	92.36
T <sub>5</sub>	RDNP + 175% RDK	37.73	49.20	76.62	95.65
	<b>S. Em ±</b>	0.85	1.28	1.80	2.25
	<b>CD (P= 0.05)</b>	2.62	3.96	5.56	6.96



**Fig. 1.**In

**fluence of graded levels of potassium fertigation on plant height**

**of Jalapeno pepper**

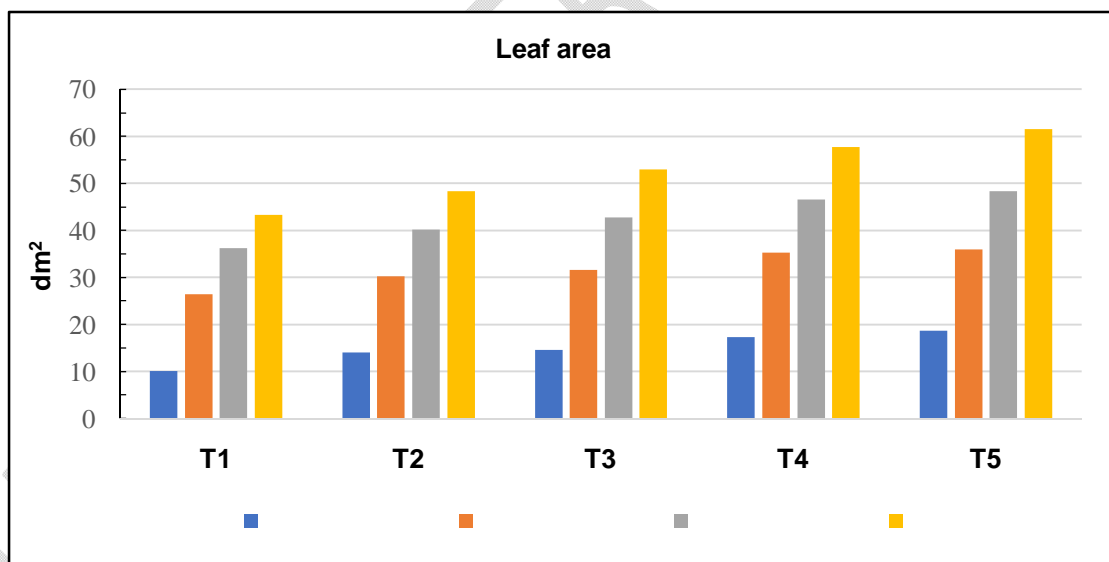
### 3.2 Leaf area

The data regarding the leaf area of Jalapeno pepper significantly influenced the graded levels of potassium fertigation are presented in Table 3 and graphically represented in fig. 2. The highest leaf area of Jalapeno pepper obtained in the treatment applied to RDNP + 175% RDK recorded (18.62 dm<sup>2</sup>), (36.01 dm<sup>2</sup>), (48.32 dm<sup>2</sup>) and (61.61dm<sup>2</sup>) after 20, 35, 50 and 65 DAT which was at par with treatment T<sub>4</sub> which received RDNP + 150%RDK and lowest leaf area was observed in control treatment (10.11 dm<sup>2</sup>), (26.39 dm<sup>2</sup>), (36.24 dm<sup>2</sup>) and (43.31dm<sup>2</sup>) after 20, 35, 50 and 65 DAT. Potassium played a crucial role in maintaining the osmotic balance within plant cells by regulating water uptake and retention. This regulation was vital for sustaining turgor pressure, which was necessary for cell expansion and had a

direct impact on leaf area. According to Mishra and Sahu. (2014) stated that expanded leaf area was obtained through appropriate nutrition consumption in response to greater dosages of nitrogen, potash and their combination. Similar result also reported by Bharamappa *et al.* (2009), Brahma *et al.* (2010), Rikza *et al.* (2021), Selim *et al.* (2021) and Kusumiyati *et al.* (2022).

**Table. 3. Influence of graded levels of potassium fertigation on leaf area of Jalapeno pepper**

Tr. no.	Treatment	Leaf area (dm <sup>2</sup> )			
		20 DAT	35 DAT	50 DAT	65 DAT
T <sub>1</sub>	Control	10.11	26.39	36.24	43.31
T <sub>2</sub>	RDF– (100:50:50) (N,P <sub>2</sub> O <sub>5</sub> ,K <sub>2</sub> Okg <sup>-1</sup> )	14.05	30.21	40.24	48.35
T <sub>3</sub>	RDNP+ 125% RDK	14.59	31.58	42.83	53.01
T <sub>4</sub>	RDNP + 150%RDK	17.31	35.29	46.61	57.74
T <sub>5</sub>	RDNP + 175% RDK	18.62	36.01	48.32	61.61
	<b>S. Em ±</b>	0.52	1.12	1.11	1.42
	<b>CD (P= 0.05)</b>	1.62	3.45	3.44	4.40



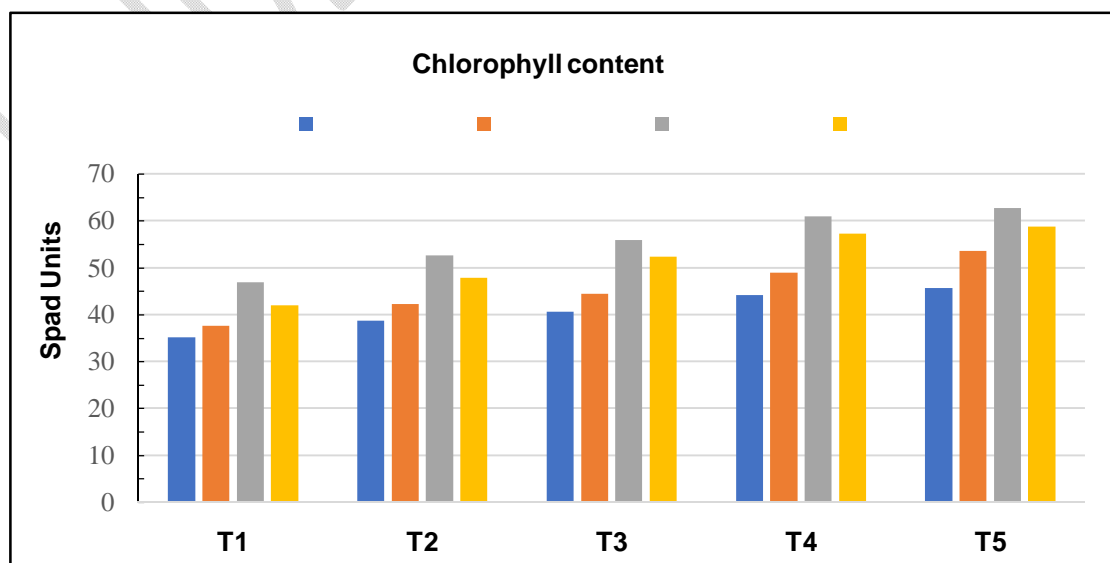
**Fig. 2. Influence of graded levels of potassium fertiligation on leaf area of Jalapeno pepper**

### 3.3 Chlorophyll content

The results related to chlorophyll content has been presented in Table 4 and graphically depicted in 4. The chlorophyll content in leaves significantly influenced the graded levels of potassium fertiligation. The greatest chlorophyll content was found in treatment T<sub>5</sub> (RDNP + 175% RDK) which received (45.66), (53.61), (62.78) and (58.83) after 20, 35, 50 and 65 DAT and it was found to be at par with T<sub>4</sub>- RDNP + 150% RDK treatment. Whereas the significantly minimum chlorophyll content (35.22), (37.63), (46.97) and (42.0) was recorded in the treatment T<sub>1</sub> after 20, 35, 50 and 65 DAT where no fertilizer was applied during the experimentation. Potassium plays a crucial role in the absorption and transport of essential nutrients, including nitrogen, a vital component of chlorophyll. Chlorophyll is the primary component in the vegetables and fruits that gives them their green colour according to Malik *et al.* (2011). Similar result also obtained by Kamal (2013) and Gokul *et al.* (2020).

**Table. 4. Influence of graded levels of potassium fertiligation on chlorophyll content in leaves of Jalapeno pepper**

Tr. no.	Treatment	Chlorophyll content (SPAD units)			
		20 DAT	35 DAT	50 DAT	65 DAT
T <sub>1</sub>	Control	35.22	37.63	46.97	42.00
T <sub>2</sub>	RDF- (100:50:50) (N:P <sub>2</sub> O <sub>5</sub> :K <sub>2</sub> Okg <sup>-1</sup> )	38.73	42.26	52.73	47.91
T <sub>3</sub>	RDNP+ 125% RDK	40.68	44.42	55.96	52.43
T <sub>4</sub>	RDNP + 150%RDK	44.24	48.93	60.97	57.25
T <sub>5</sub>	RDNP + 175% RDK	45.66	53.61	62.78	58.83
	<b>S. Em ±</b>	1.10	1.41	1.52	1.45
	<b>CD (P= 0.05)</b>	3.41	4.36	4.68	4.48



**Fig.3.Influence of graded levels of potassium fertigation on chlorophyll content in leaves of Jalapeno pepper**

#### **4. CONCLUSIONS**

Based on the results it could be determined that the Influence of Graded Levels of Potassium Fertigation on Growth of Jalapeno Pepper Grown in Red Bole Soil Under Polyhouse. Enhancing the concentration of RDK above the recommended dose particularly at 175% (T<sub>5</sub>) levels, significantly enhanced plant height, leaf area and chlorophyll content suggesting that a higher potassium supply promoted better growth.

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#### **DISCLAIMER**

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during writing or editing of manuscripts. COMPETING INTERESTS: Authors have declared that no competing interests exist.

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