EFFECT OF POTASSIUM AND NITROGEN ON YIELD OF PEPPER (*CAPSICUM ANNUUM L.*) CV CHARISMA UNDER PROTECTED CULTIVATION

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ABSTRACT : The present investigation entitled Effect of potassium and Nitrogen on yield of pepper (*Capsicum annuum* L.) cv charisma under protected cultivation **.**The experiment was carried out at the desert region in karbala during winter 2014 with following treatments of which was K 1 (0), K 2 (10), K 3 (15) and K 4 (20) kg potassium sulfate per poly house (504 m^2) and N1 (0), N2 (30) and N3 (60) kg urea per poly house (504 m^2) .The cultivar of pepper was *CHARISMA* . the highest number of fruit (22.100),fruit weight (184.100 g), yield per plant (4.069 kg) and total yield per poly house (3.255 tones) was obtained in Urea 60 kg + potassium sulfate 20 Kg (504 m^2) .

KEYWORDS: pepper , *Capsicum annuum* L**.** , number of fruit, fruit weight , yield per plant , total yield per poly house

INTRODUCTION

Pepper **(*Capsicum annuum* L.)** belongs to family solanaceae. Pepper one of most popular and nutritious fruit vegetable [9] . Pepper is considered to be the most important vegetable crops in the Mediterranean region. [9] . pepper has its origin in South America, where he found a wild situation different forms and then moved to India warm and tropical regions and in all the continents of the world as root eastern India, China, Spain, Greece and Africa [21] . The crop is grown in most parts of Iraq in open fields as well as in facilities protected agriculture .Pepper total area under pepper crop in Iraq is assessed to be 14101 tones with the productivity of 28568 tones [6] . Pepper is grown for its fruits are eaten fresh and is completely green before maturity or after maturity and fully colored, peppers and fruits rich in vitamin C, which the body needs especially in the winter season to resist the cold and flu illnesses as they are relatively rich in vitamin (A) [18] .

To improve the yield of the produce , it is necessary to pay attention on optimum balance use of nutrient through fertilizer application pepper The solanacea vegetable crops generally take up large amounts of nutrients from the soil [17]. In recent years, because of increased levels of K fertilizer are important for better nutrient management. Growers and farmers need to manage the fertilizer for better quality of fruit production. Potassium is considered to be one of the most essential elements for the growth and development of plants [19], [26] .and [21] .studies have proved that K plays a major role in many physiological and biochemical processes such as enzyme activation; metabolism of carbohydrates and protein compounds. Potassium is the most prominent inorganic chemical influencing plant physiology [15] .Also potassium has a significant role to play in the plant energy status for storage of assimilates and tissue water relation. K plays a key role in crop quality [7]; [17] . K also improves the size of the fruit and stimulates root growth [15] ,[17] . [12]indicated that biomass, fruit count, and fruit weight per plant increased linearly with increasing K rate. studies reported that the total yield, marketable yield, commercial fruit yield and total average yield per plant were increased by increasing application rates of potassium (K).

Nitrogen (N) is a major constituent of several of the most important substances which occur in plants. It is of outstanding importance among the essential elements in the N compounds comprise from 40 to 50% of the dry matter of the protoplasm, the living substance of plant cells [24]. Nitrogen is known to promote production, partitioning and

accumulation of dry matter in crop plant [3] , [13] . observed that N fertilizer is an essential component for good yield and fruit production of tomatoes [22]. reported that N fertilizer increased fruit weight, yield and fruit number of chilli peppers. [5]reported that N fertilizer increased leaf chlorophyll and had a linear relationship between leaf chlorophyll content and leaf nitrogen concentration. It is well known that adequate N is required by pepper for satisfactory growth, development and yield. Thus the main aims of this experiment were.

To determine levels of potassium and Nitrogen that lead to optimum plant yield of pepper.

MATERIALS AND METHODS

The présent investigation "effect of potassium and nitrogen on yield of pepper under protected cultivation"was carried out during Winter season 1/10/2014 at desert region of karbala . The experiment was laid out in factorial experiment conducted in a R.B.D with three replication and four treatments of Potassium and three treatments of nitrogen. potassium was applied as potassium sulfate was applied recommended dose viz (0 , 10 , 15 and 20 kg per poly house). Nitrogen was applied as urea was applied recommended dose viz (0 , 30 and 60 kg per poly house) phosphore was applied as Triple superphosphate was applied recommended dose 22 Kg to all treatments , N fertilizer levels was applied to the soil four times at equal and constant levels(the first portion was applied tow week after transplanting stage and three next portion was applied between time and time two weeks. K fertilizer levels was applied to the soil tow times at equal and constant levels (the first portion was applied one week before transplanting stages, the second portion was applied six week after transplanting. total dose of Triple superphosphate was applied as basal dose one week before transplanting .

Details of Layout

Crop	:	PEPPER
Cultivar	:	*CHARISMA*
Design of experiment	:	factorial experiment conducted in a R.B.D
No. of replications	:	3
No. of treatment	:	12
Total no. of plots	:	36
Spacing plant to plant	:	40cm
Total No. of plants/plot	:	10
Total No. of plants in field	:	360

Treatments Detail

Treatment No.	Treatment Detail
T_1	Control
T_2	potassium sulfate 10 Kg per plastic house (504 m^2)
T_3	potassium sulfate 15 Kg per plastic house (504 m^2)
T_4	potassium sulfate 20 Kg per plastic house (504 m^2)
T_5	Urea 30 kg Kg per plastic house (504 m^2)
T_6	Urea 30 kg + potassium sulfate 10 Kg (504 m^2)
T_7	Urea 30 kg + potassium sulfate 15 Kg (504 m^2)

T_8	Urea 30 kg + potassium sulfate 20 Kg (504 m^2)
T_9	Urea 60 kg per plastic house (504 m^2)
T_{10}	Urea 60 kg + potassium sulfate 10 Kg (504 m^2)
T_{11}	Urea 60 kg + potassium sulfate 15 Kg (504 m^2)
T_{12}	Urea 60 kg + potassium sulfate 20 Kg (504 m^2)

RESULTS AND DISCUSSIONS

Number of Fruits per Plant

The data presented in table (1) clearly showed that the potassium played significant role in affecting number of fruits per plant. The maximum number of fruits per plant was recorded statistically significant in potassium application T_4 (20 kg per poly house) which was recorded (21.467), followed by T3 (15 kg per poly house) which was recorded (19.250 g) superior over control which was recorded (15.728) . Result showed that N significantly affected the number of fruits per plant where N levels were superior over control, where (Urea 60 kg per poly house (504 m^2) level gave highest number of fruits per plant (20.158), followed by @ Urea 30 kg Kg per poly house (504 m^2) (18.429). The minimum number of fruits per plant was noticed with control (17.633). K combination with N played significant role in affecting number of fruits per plant where superior interaction (Urea 60 kg + potassium sulfate 20 Kg (504 m^2) on other interactions which was recorded (22.100), followed by @ Urea 30 kg + potassium sulfate 20 Kg (504 m^2) (21.533).The minimum number of fruits per plant was noticed with control (14.667) These results are in close conformity with the finding of [7] , [14] ,[1] and[2]

Fresh Weight of Fruit (g)

Result showed in table(2) the potassium played significant role in affecting fresh weight of fruit (g). The maximum fresh weight of fruit was recorded statistically significant in potassium application T_4 (20 kg per poly house) which was recorded (169.867g), followed by T3 (15 kg per poly house) which was recorded (159.178 g) superior over control which was recorded (137.889 g) . Result showed that N significantly affected the Fresh Weight of Fruits per plant where N levels were superior over control, where (Urea 60 kg per poly house (504 m^2) level gave highest Fresh Weight of Fruits per plant (163.421 g), followed by @ Urea 30 kg Kg per poly house (504 m^2) (156.446 g). The minimum Fresh Weight of Fruits per plant was noticed with control (139.650 g) . N interaction with K application significant role in affecting fresh weight of fruit where superior interaction (Urea 60 kg + potassium sulfate 20 Kg (504 m^2) on other interactions which was recorded (184.100 g) , followed by @ Urea 30 kg + potassium sulfate 20 Kg (504 m^2) (178.500 g) . The minimum fresh weight of fruit was noticed with control (130.167 g) .Similar findings were obtained by [7] ,[25] and [6] .

Fruit Yield $Plant^{-1}$ (kg)

The data presented in table(3)clearly showed that the potassium played significant role in affecting fruit yield per plant. The maximum fruit yield per plant was recorded statistically significant in potassium application T_4 (20 kg per poly house)which was recorded (3.655 kg), followed by T3 (15 kg per poly house) which was recorded (3.076 kg) superior over control which was recorded (2.175 kg). Result showed that N significantly affected the fruit yield per plant where N levels were superior over control, where (Urea 60 kg per poly house (504 m^2) level gave highest fruit yield per plant (3.318

kg), followed by @ Urea 30 kg Kg per poly house (504 m^2) (2.916). The minimum fruit yield per plant was noticed with control (2.476 kg). K combination with N played significant role in affecting fruit yield per plant where superior interaction(Urea 60 kg + potassium sulfate 20 Kg (504 m^2) on other interactions which was recorded (4.069 kg), followed by @ Urea 30 kg + potassium sulfate 20 Kg (504 m^2) (3.843 kg). The minimum fruit yield per plant was noticed with control (1.909 kg).Similar results were reported by [25] ,[7] and [2] .

Total yield per poly house (tones)

Result showed in table(4) the potassium played significant role in affecting Total yield of fruit (tones). The maximum Total yield was recorded statistically significant in potassium application T_4 (20 kg per poly house) which was recorded (2.924 tones), followed by T3 (15 kg per poly house) which was recorded (2.461 tones) superior over control which was recorded (1.740 tones) . Result showed that N significantly affected the Total yield where N levels were superior over control, where (Urea 60 kg per plastic house (504 m^2) level gave highest Total yield per plant (2.655 tones), followed by @ Urea 30 kg per plastic house (504 m^2) (2.333 tones). The minimum Total yield was noticed with control (1.980 tones) . N combination with K application significant role in affecting Total yield where superior interaction(Urea 60 kg + potassium sulfate 20 Kg (504 m^2) on other interactions which was recorded (3.255 tones), followed by @ Urea 30 kg + potassium sulfate 20 Kg (504 m^2) (3.075 tones) . The minimum Total yield was noticed with control (1.527 tones) .Similar results were reported by [6], [14],[5] and [25] in (pepper).

DISCUSSIONS

Potassium is considered to be one of the most essential elements for the growth and development of plants [19] [26]. and [21]. K plays a major role in many physiological and biochemical processes such as enzyme activation, metabolism of carbohydrates and protein compounds. Potassium is the most prominent inorganic chemical influencing plant physiology [16]. Also potassium has a significant role to play in the plant energy status for storage of assimilates and tissue water relation . K also improves the size of the fruit and stimulates root growth [16]. [17]. .[12] indicated that biomass, fruit count, and fruit weight per plant increased linearly with increasing K rate. results may be due to the role of potassium element in metabolism and many processes needed to sustain and promotion plant vegetative growth and development. Moreover, many studies proved that K plays a major role in many physiological and biochemical processes such as cell division and elongation and metabolism of carbohydrates and protein compounds [10].application of potassium which might have accelerate the vigorous growth and increase of fruit per plant , fruit weight and total yield .

Nitrogen (N) is a major constituent of several of the most important substances which occur in plants. It is of outstanding importance among the essential elements in the N compounds comprise from 40 to 50% of the dry matter of the protoplasm, the living substance of plant cells [24]. Nitrogen is known to promote production, partitioning and accumulation of dry matter in crop plant [3]. [13]. observed that N fertilizer is an essential component for good yield and fruit production of tomatoes [22]. reported that N fertilizer increased fruit weight, yield and fruit number of chilli peppers. [5]. reported that N fertilizer increased leaf chlorophyll and had a linear relationship between leaf chlorophyll content and leaf nitrogen concentration. It is well known that adequate N is required by pepper for satisfactory growth, development and yield.

CONCLUSION

Based on the result of experimental it was aimed to identify suitable treatment for pepper with respect to productivity of pepper during winter 2014 . it may be concluded that the treatment T 4 (potassium sulfate 20 Kg per poly house (504 m^2),T 9 (Urea 60 kg per poly house (504 m^2)) and T 12 (Urea 60 kg + potassium sulfate 20 Kg (504 m^2)), was recorded the best among treatments on yield the treatments were obtained the highest total yield (2.924 , 2.655 and 3.255) tones in poly house (504 m^2) respectively under protected cultivation.

Table (1) Effect of potassium and nitrogen on number of fruits per plant of pepper

Treatments	Number of Fruits per Plant	Treatments	Number of Fruits per Plant	Treatments	Number of Fruits per Plant			
					K0	K 1	K 2	K 3
K 0 Control	15.728	N0 Control	17.633	N 0	14.667	17.083	18.017	20.767
K1 10 kg /poly house	18.517	N1 30 kg /poly house	18.429	N 1	15.250	18.100	18.833	21.533
K2 20 kg /poly house	19.250	N2 60 kg /poly house	20.158	N 2	17.267	20.367	20.900	22.100
K3 30 kg /poly house	21.467							
F - test	S		s	F - test	s			
S. Ed	0.074		0.056	S. Ed	0.222			
CD at 5%	0.154		0.115	CD at 5%	0.461			

Table (2) Effect of potassium and nitrogen on fresh weight of fruits (g)of pepper

Treatments	Fruit weight(g)	Treatments	Fruit weight(g)	Treatments	Fruit weight (g)			
					K0	K 1	K 2	K 3
K 0 Control	137.889	N0 Control	139.650	N 0	130.167	139.500	141.933	147.000
K1 10 kg /poly house	145.756	N1 30 kg /poly house	156.446	N 1	138.417	143.600	165.267	178.500
K2 20 kg /poly house	159.178	N2 60 kg /poly house	163.421	N 2	145.083	154.167	170.333	184.100
K3 30 kg /poly house	169.867							
F - test	S		S	F - test	S			
S. Ed	0.481		0.361	S. Ed	1.443			

CD at 5%	0.998		0.748	CD at 5%	2.993			

Table (3) Effect of potassium and nitrogen on fruit yield plant^{-1} (kg) of pepper

Treatments	Fruit Yield Plant^{-1} (kg)	Treatments	Fruit Yield Plant^{-1} (kg)	Treatments	Fruit Yield Plant^{-1} (kg)			
					K0	K 1	K 2	K 3
K 0 Control	2.175	N0 Control	2.476	N 0	1.909	2.383	2.557	3.052
K1 10 kg /poly house	2.708	N1 30 kg /poly house	2.916	N 1	2.111	2.600	3.111	3.843
K2 20 kg /poly house	3.076	N2 60 kg /poly house	3.318	N 2	2.504	3.140	3.560	4.069
K3 30 kg /poly house	3.655							
F - test	S		s	F - test	s			
S. Ed	0.013		0.010	S. Ed	0.038			
CD at 5%	0.027		0.020	CD at 5%	0.080			

Table (4) Effect of potassium and nitrogen on total yield per poly house (tones) of pepper

Treatments	Total yield of fruit (tones)	Treatments	Total yield of fruit (tones)	Treatments	Total yield of fruit (tones)			
					K0	K 1	K 2	K 3
K 0 Control	1.740	N0 Control	1.980	N 0	1.527	1.907	2.046	2.442
K1 10 kg /poly house	2.166	N1 30 kg /poly house	2.333	N 1	1.689	2.080	2.489	3.075
K2 20 kg /poly house	2.461	N2 60 kg /poly house	2.655	N 2	2.003	2.512	2.848	3.255
K3 30 kg /poly house	2.924							
F - test	S		S	F - test	s			
S. Ed	0.010		0.008	S. Ed	0.031			
CD at 5%	0.021		0.016	CD at 5%	0.064			

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