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Effect of different colour mulches, fertigation levels and levels of irrigation on growth and yield of transplanted pigeonpea

B Maheshwara Babu, Nagaraj DM and Ramesh G

Abstract
An experiment was conducted in the research field of College of Agricultural Engineering, University of Agricultural Sciences, Raichur, during 2019-20 to study the effect of different colour mulches, fertigation levels and levels of irrigation on growth and yield of pigeonpea. Two levels of fertigation (75% RDF and 100% RDF), three levels of irrigation (60% ET, 80%ET and 100% ET) and three color plastic mulches (white, silver, black and control) were the treatments. All the parameters like plant height, number of primary and secondary branches, chlorophyll content, soil moisture and soil temperature at surface and at 10 cm depth, leaf area index, harvest index, number of pods per plant, seeds per pod, test weight, seed yield, dry matter production recorded highest in the white mulch with 100 per cent RDF and 100 per cent ET. The maximum seed yield (2161.69kg ha^{-1}) was recorded with 100 per cent RDF. Lowest seed yield (2001.48 kg ha^{-1}) was observed with the application of 75 per cent RDF. Drip irrigation at 100 per cent ET produced significantly maximum yield (2302.88 kg ha^{-1}) and minimum yield was recorded in 60 per cent ET (2161.38 kg ha^{-1}). Among plastic colour mulches, white plastic mulch produced significantly maximum yield (2384 kg ha^{-1}). While minimum yield was recorded in the control treatment (2001.57kg ha^{-1}).Water use efficiency was found to b emaximum in 100 per cent RDF, 100 per cent ET and white plastic mulch (5.71 kg ha^{-1} mm^{-1}). Nitrogen and phosphorous use efficiency was 111.01% and 55.5%, respectively in 100 per cent RDF, 100 per cent ET and white plastic mulch.

Keywords: drip irrigation, plant development, harvest index, transplanted pigeon pea and yield

1. Introduction

The primary source of water in agricultural production in most parts of the world is rainfall. The three main factors that characterize rainfall are amount, frequency and intensity; the values of which vary spatially and temporally. When the weather does not provide enough rainfall to feed agricultural crops, farmers should supplement the available water through surface and groundwater irrigation. This would help to manage the soil moisture and nutrient concentration in soil, which further would create an optimum-growing environment.

Pigeonpea [*Cajanus cajan* (L.) Millsp] is an important food legume of the semi-arid tropics of Asia and Africa. It occupies a prime niche in sustainable rainfed farming systems of small and marginal farmers and also occupies a prominent place in Indian rainfed agriculture. More than 85 per cent of the world pigeonpea is produced and consumed in India. It is commonly known as redgram or arhar or tur or thogari. India is the largest producer and consumer of pigeonpea grown in an area of 3.88 M ha with an annual production of 3.29 M t and productivity of 849 kg ha^{-1}. The productivity of pigeonpea in Karnataka and India is far below the average productivity of the world (848 kg ha^{-1}). In India, it is one of the very important grain legume crops and it is mainly grown in the states of Maharashtra, Karnataka, Madhya Pradesh, Uttar Pradesh and Gujarat.

In dry farming areas of northern Karnataka, the rainfall is not only scanty but also erratic. Thus, soil moisture becomes the most limiting factor in pigeonpea production. In order to ensure timely sowing under delayed onset of monsoon, the transplanting of pigeonpea seedlings is the better agronomic measure to overcome delayed sowing. Pigeonpea suffers more when sowing is delayed. Early sowing of pigeonpea *i.e.*, in the month of May, ensures higher yield.

Use of plastic mulch in agriculture known as plastic-culture is becoming popular in Indian agriculture for boosting crop production. By using high yielding variety, intensive fertilizer and pesticides, the agricultural strategies today is moving towards boosting crop yield through ecologically sensitive technologies and better water management practices. In our country generally organic mulches are used for moisture conservation and soil temperature moderation, but they have partial control over weed growth, hence use of plastic mulches has more advantages.

Water that evaporates from the soil under the plastic film condenses on the lower surface of the film and falls back to the soil as droplets. As a result of this soil moisture is preserved and consumed by the crop (Ashworth and Harrison, 1983) [4]. The mulch film prevents the direct impact of rain on the soil and maintains a porous soil structure. Thus better moisture movement and gaseous exchange takes place in mulched soils. This process increases the concentration of carbon dioxide around the mulch film and improves photosynthesis.

Fertigation gives flexibility in fertilizer application, which enables the crop to meet the specific nutritional requirement at different stages of its growth. Split application of fertilizers ensures required nutrients in right time and in right proportions for getting higher yield with minimum loss of nutrients. Nitrogen, phosphorus and potassium fertilizers are water soluble and thus they play a major role in the growth and development of crop plants. Drip irrigation and fertigation are technologies which improve both water and fertilizer use efficiency to a great extent (Sanjay *et al*., 2017) [13]. Hence this study was designed with an objective of studying the effect of different colour mulches, fertigation levels and levels of irrigation on growth and yield of transplanted pigeonpea.

Material and Methods

The experiment was conducted in research field of College of Agricultural Engineering, Raichur, which is situated in the Northeastern dry zone which comes under Zone II in region-1 of Karnataka. It is located at 16˚15' N latitude and 77˚20′ E longitude and at an elevation of 389 m above mean sea level (MSL).The climate of this region has warmer temperature of (36˚C), maximum average relative humidity of 92.3 per cent and the maximum evaporation of 9 mm day^{-1}.The experimental field has clay textured soil. Before transplanting of pigeonpea, soil had available nitrogen, phosphorous and potassium to the extent of 180 kg ha^{-1}, 15.3 kg ha^{-1}and 98.10 kg ha^{-1}respectively. After harvesting, the soil had available nitrogen, phosphorous and potassium to the extent of 176.4 kg ha^{-1}, 15.1 kg ha^{-1} and 96.21 kg ha^{-1}respectively. Infiltration rate was measured by using double ring infiltrometer and it was found to be 1.53 cm h^{-1}. The textural composition of the soil was found to posses 14.68 per cent of sand, 40.10 per cent of silt and 46.32 per cent of clay type of soil. The density of soil was found to be 1.42 g cm^{-3}. The field capacity and permanent wilting point were found to be 23.15 per cent and 10.22 per cent respectively by Pressure Plate apparatus.

There were two main treatments of fertigation levels (75 per cent of RDF through fertigation and 100 per cent of RDF through fertigation), three sub treatments (drip irrigation at 60 per cent of ET, drip irrigation at 80 per cent of ET and drip irrigation at 100 per cent of ET) and sub-sub treatments (White over black, Silver over black, Complete black plastic mulch and Control). The lateral of 16 mm diameter was used for drip irrigation. Drippers at 4liters per hour capacity were used at a spacing of 90 cm for drip irrigation treatments in each raised bed plots.

The land was thoroughly ploughed and brought to fine tilt. Then the experimental field was prepared with raised beds of 6.3m length, 1m width and 0.15m height. **S**urface drip irrigation was used for the experiment. The polyethylene mulch sheet was spread over the bed after preparation of raised beds as per the treatments. The plastic mulches of white on black, silver on black and black were laid out. Plastic mulching was of 30 micron in thickness. Holes of 10 cm diameter were made on the laid out plastic mulch at a distance of 90 cm in each row which were 150 cm apart. The pigeonpea variety used in the experiment was BSMR-736. This variety is a medium duration (180-190 days) variety with indeterminate growth habit. Two bold and healthy seeds of pigeonpea were sown in polythene bags (4”×6”) having 3/4th of soil and 20 g of vermicompost. The polythene bags were watered regularly. After one month, the seedlings were transplanted in the main field by removing the polythene cover without disturbing the soil at the root zone. The seedlings were transplanted at a distance of 90 cm in rows which were 150 cm apart.

To lift the water, 7.5 hp submersible pump was used and water conveyed to the field using 63 mm diameter PVC pipe. After filtering through the disc filter, the water was conveyed to the field using 50 mm sub main. From the sub main, laterals of 16 mm diameter LLDPE pipes were installed. Each lateral was provided with individual tap control for imposing fertigation and irrigation. Irrigation was given to all the treatment plots immediately after transplanting**.** Five plants from net plot were selected at random and tagged for the purpose of recording various observations. Observations on growth parameter at four distinct stages of crop growth, *i.e.* 45, 90, 135 DAT and at harvest were recorded on tagged plants. The water use efficiency of each treatment was computed as yield of pigeonpea to total amount of water used in the field.

The analysis and interpretation of the data were done using the fisher’s method of analysis of variance technique as given by Panse and Sukhatma (1967) [11]. The value of significance used in ‘F’ and ‘t’ test was at 5% probability level and wherever ‘F’ test was found significant, the ‘t’ test was performed to estimate critical difference among various treatments.

Results and Discussion

Growth Parameters

All the growth parameters like plant height, number of primary and secondary branches, chlorophyll content, leaf area index, root length and root spread was maximum with 100 per cent ET and 100 per cent RDF.

Fertilizer levels: Among fertilizer application, the plant height (171.21cm), number of primary (18.6) and secondary branches (50.54), chlorophyll content (42.56), leaf area index (2.34), root length (49.26 cm), root spread (74.25cm), harvest index (0.45), number of pods per plant (698.88), seeds per pod (3.91), test weight (12.5), seed yield (2161.69 kg ha^{-1}) and dry matter production (491.33g per plant), was maximum with 100 per cent RDF at all stages of plant growth and at harvest. All the parameters linearly and significantly decreased as the fertilizer level decreased. The plant height (169.75), number of primary (18.03) and secondary branches (48.57), chlorophyll content (42.26), leaf area index (1.78), root length (47.48cm), root spread (67.24 cm), harvest index (0.58), number of pods per plant (615.94), seeds per pod (3.78), test weight (11.48), seed yield (2001.48kg ha^{-1}) and dry matter production (468.72g per plant) was minimum with 75 per cent RDF at all the stages of plant growth and at harvest.

Soil moisture at surface (20.57%), soil moisture at 10 cm depth (20.71%), soil temperature at surface (32.91 ºC) and soil temperature at 10 cm depth (33.48 ºC) was found to be maximum with 100 per cent RDF at all the stages of plant growth.

The taller plant at 100 per cent fertilizer through drip irrigation might be due to increase in the level of fertilizer through fertigation. The increase in plant height and number of branches due to the nitrogen application can be attributed to the fact that nitrogen is a major component of protoplasm which helps in photosynthesis and enhances the metabolic rate, cell division and cell elongation which facilitates the plant to grow at a faster rate. Phosphorus enhances the root elongation, leaf expansion due to cell elongation (Sanjay *et al.*, 2017) [13]. Similar results were obtained in tomato crop by Amarananjundesh wara (1997) [2].

Irrigation levels: Treatment comprising of irrigation at 100 per cent ET fared better among the different irrigation treatments recording higher plant height (169.81 cm), number of primary (19.05) and secondary branches (50.53), chlorophyll content (44.95%), leaf area index (2.43), root length (45.32 cm), root spread (73.33cm), harvest index (0.49), number of pods per plant (721.32), seeds per pod (4.96), test weight (14.29), seed yield (2302.88 kg ha^{-1}) and dry matter production (483.83g per plant), at all the stage of plant growth and at harvest. Meanwhile plant height (150.15 cm), number of primary (18.21) and secondary branches (48.65), chlorophyll content (40.51), leaf area index (1.84), root length (50.81 cm), root spread (68.11cm), harvest index (0.31), number of pods per plant (596.93), seeds per pod (3.96), test weight (11.40), seed yield (2161.38 kg ha^{-1}) and dry matter production (427.08g per plant), was minimum with 60 per cent ET at all the stages of plant growth and at harvest.

Soil moisture at surface (20.15%), soil moisture at 10 cm depth (20.21%), soil temperature at surface (32.96 ºC) and soil temperature at 10 cm depth (33.67 ºC) was found to be maximum with 100 per cent ET at all the stages of plant growth.

Higher frequency of irrigation increased the availability of soil moisture under drip irrigation. This might have led to the effective utilization of available nutrients and better proliferation of roots resulting in quick canopy and higher growth as reported by Jitendra Singh *et al*. (2018) [7].

Drip irrigation provides appropriate moisture at field capacity, ensures better root development in terms of length and spread of roots, which facilitate luxuriant growth of plant due to better nutrient uptake resulting in better pod development, ultimately leading to higher yields. The above results are in good agreement with the studies of Yohannes *et al.* (1998) [18] and Mukherjee *et al.* (2010) [9].

Mulch levels: Different types of plastic colour mulch also influenced the plant height significantly. Mulching of soil with white mulches resulted in better plant height (185.50 cm), number of primary (23.88) and secondary branches (50.08), chlorophyll content (46.19), leaf area index (2.66), root length (49.36 cm), root spread (78.66cm), harvest index (0.48), number of pods per plant (787.18), seeds per pod (5.14), test weight (13.41), seed yield (2318.47kg ha^{-1}) and dry matter production (492.78g per plant) at all the stages of crop growth and at harvest. Minimum readings were recorded in control treatment without mulch for plant height (169.46 cm), number of primary (16.08) and secondary branches (43.50), chlorophyll content (38.32), leaf area index (1.27), root length (53.62 cm), root spread (60.76 cm), harvest index (0.22), number of pods per plant (617.52), seeds per pod (3.83), test weight (11.14), seed yield (2001.57 kg ha^{-1}) and dry matter production (402.78g per plant) at all the stages of crop growth and at harvest.

Soil moisture at surface (17.61%), soil moisture at 10 cm depth (17.67%), soil temperature at surface (31.62 ºC) and soil temperature at 10 cm depth (32.46 ºC) was found maximum in the treatment with white plastic mulch at all the stages of plant growth.

The soil temperature in the beds increased due to plastic mulch and this might have promoted faster crop development and early harvest. Mulching decreases the fluctuations in temperature in the first 20-30 cm depth in the soil and promotes the root development and reduces vegetative competition in the rooting zone and reduces fertilizer leaching (Mohammad *et al.*, 2017) [8]. Higher soil temperature under plastic colour mulches may be due to increased radiation absorption and better thermal conductivity between soil surface and the plastic mulch. These results are in agreement with Jay Ham *et al.* (1993) [6] and Tapani *et al.* (2015) [15]. The positive influence of white plastic mulch on plant height and number of branches might be due to the reason that mulches directly affect the microclimate around the plant by modifying the radiation budget of the surface and decreasing the soil water loss resulting in adequate availability of moisture to plants. This results in full cell turgidity and eventually higher meristematic activity, leading to more foliage development, greater photosynthetic rate and consequently better plant growth (Sushma *et al*., 2017) [14]. These results are in agreement with the findings of Ashrafuzzaman *et al.* (2011) [3].

It can be seen that in mulched plots highest soil moisture content was observed at ground surface level and 10 cm depth, than without mulch plots. The water vapours from the soil were trapped by the plastic sheet resulting in water vapour again being dropped on the upper surface of soil. Hence the moisture retention capacity of the soil gets increased by reducing the evaporation losses. These results are in agreement with Abu-Bakr *et al.* (2003) [1].

Further, the incremental growth of pigeonpea is a result of polyethylene mulching treatments may be due to the increase in light reflectivity from the reflective mulch surface which promotes greater photosynthetic activity to the plants, on the other hand, the primary purpose for using mulches is that white mulches will reduce light penetration to the soil (Helaly *et al.*, 2017) [5]. White mulch reflects more total photosynthetic light than other mulches, which acts through the photochrome system within a plant. This might have contributed for higher dry matter production.

Water use efficiency: Among the fertigation levels, water use efficiency was found maximum with 100 per cent RDF (5.23 kg ha^{-1} mm^{-1}) and minimum water use efficiency was found with 75 per cent RDF (4.99 kg ha^{-1} mm^{-1}). Among irrigation levels water use efficiency was found maximum with 100 per cent ET (6.24 kg ha^{-1} mm^{-1}) and minimum water use efficiency was found with 60 per cent ET as (4.19 kg ha^{-1} mm^{-1}).Among mulches, water use efficiency was found maximum (5.71 kg ha^{-1} mm^{-1}) with white colour plastic mulch and minimum 4.17 kg ha^{-1} mm^{-1}water use efficiency was found in treatment without mulch as shown in Fig 1.Muralidhar (1999) [10] reported higher WUE (2.34 kg m^{-3}) by application of 100 per cent recommended dose of water soluble fertilizer through drip irrigation in capsicum.

In the combined effect, the highest water use efficiency was found in treatment of 60 per cent ET using white colour plastic mulch, similarly minimum water use efficiency was found in 100 per cent ET with control. This was due to the fact that white and silver plastic colour mulch might have provided a better condition for the increase in plant height, leaves population, leaves metabolic activities leading to the increase in the yield of the crop. The present results obtained are in line with the findings of Paul *et al.* (2013) [12] and Vijaykumar *et al.* (2012) [16].

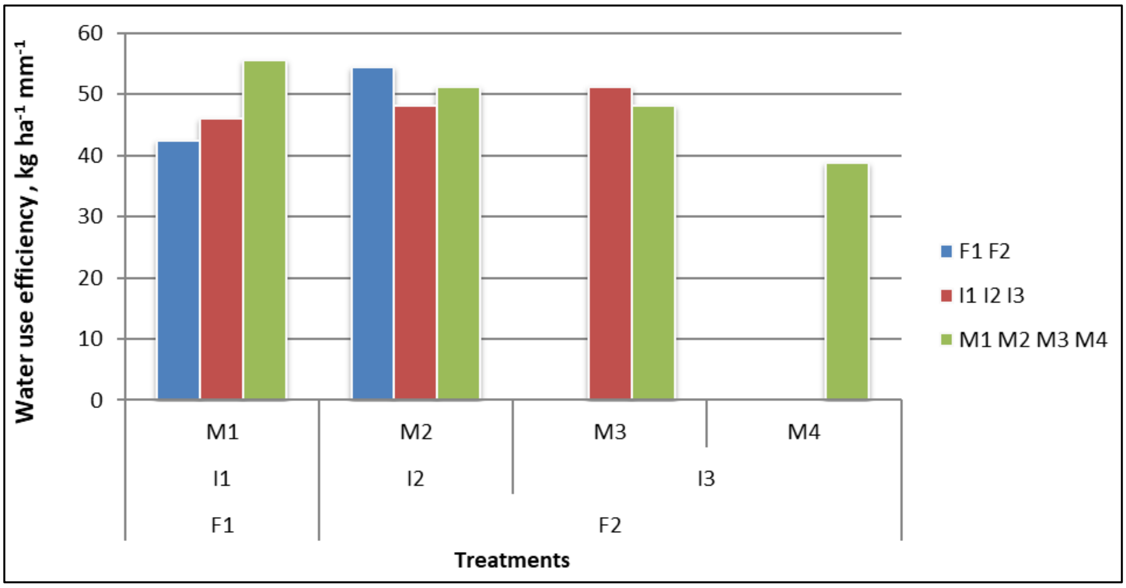

Fig 1: Water use efficiency as influenced byfertilizer levels, irrigation levels and colour plastic mulches in pigeon pea.

Nitrogen use efficiency: Among fertigation levels nitrogen use efficiency was found maximum with 100 per cent RDF (108.72%) and minimum nitrogen use efficiency was found with 75 per cent RDF (85.02%). Among irrigation levels nitrogen use efficiency was found maximum with 100 per cent ET (102.38%) and minimum water use efficiency was found with 60 per cent ET (92.01%). Among mulches, nitrogen use efficiency was found maximum with white colour plastic mulch (111.01%) and minimum nitrogen use efficiency was found in treatment without mulch (77.5%) as shown in fig 2.

The total nitrogen uptake by pigeonpea varied significantly due to drip irrigation and fertigation. The continuous availability of soil moisture content helped to solubilize the plant nutrient near the root zone and favored easy absorption of plant nutrients. The nitrogen per cent in stem and leaves declined as the plants developed and there was net mobilization of nitrogen from these organs, resulting in higher yield (Vimalendran and Latha, 2016) [17].

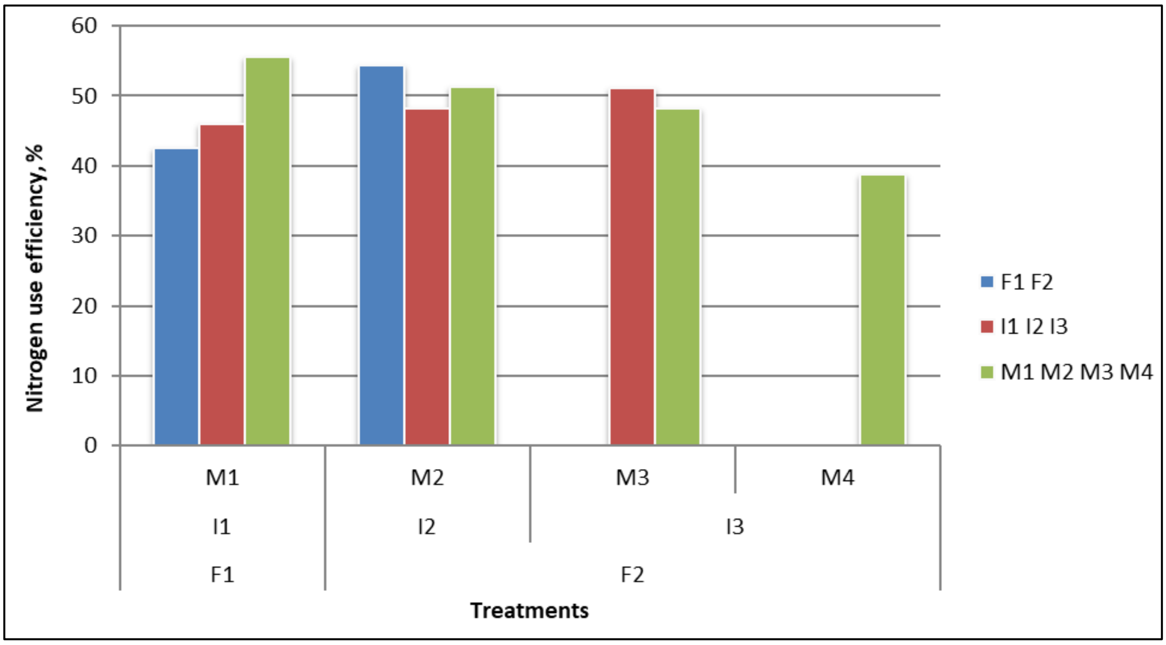

Fig 2: Nitrogen use efficiency on fertilizer levels, irrigation levels and colour plastic mulches in pigeon pea.

Phosphorous use efficiency: Among fertigation levels phosphorous use efficiency was found maximum with 100 per cent RDF (54.36%) and minimum phosphorous use efficiency was found with 75 per cent RDF (42.51%). Among irrigation levels phosphorous use efficiency was found maximum with 100 per cent ET (51.19%) and minimum phosphorous use efficiency was found with 60 per cent ET (46%). Among mulches phosphorous use efficiency was found maximum with white colour plastic mulch (55.5%) and minimum phosphorous use efficiency was found in treatment without mulch (38.75%) as shown in fig 3. Phosphorus is another important nutrient that favours good growth, adequate flowers and proper pod setting and nodule development (Vimalendran and Latha, 2016) [17].

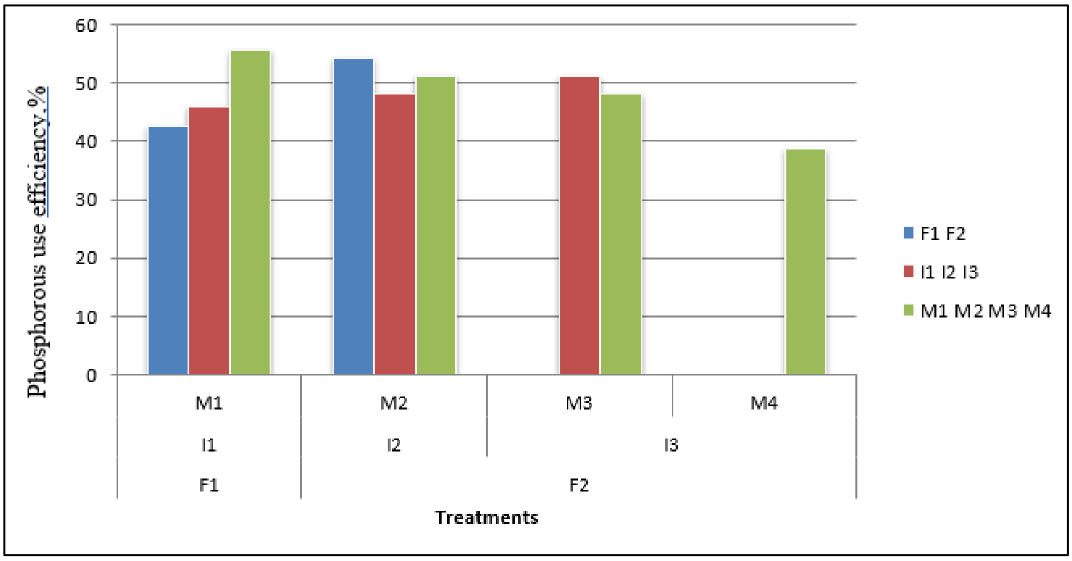

Fig 3: Phosphorous use efficiency on fertilizer levels, irrigation levels and colour plastic mulches in pigeonpea.

Table 1: Growth parameters of pigeonpea as influenced by fertilizer levels, irrigation levels and colour plastic mulches

Treatments	Plant height (cm)	Primary branches	Secondary branches	Root length (cm)	Root spread (cm)
Fertilizer levels :					
F_1	169.75	18.03	48.57	47.48	67.24
F_2	171.21	18.60	50.54	49.26	74.25
S.Em±	0.86	0.20	0.96	0.17	0.18
C.D. at 5%	2.89	0.55	2.65	1.03	1.07
Irrigation levels:					
I_1	150.15	18.21	48.65	50.81	68.11
I_2	151.48	18.31	49.48	48.16	71.12
I_3	169.81	19.05	50.53	45.32	73.33
S.Em.±	4.35	0.41	1.69	0.26	0.25
C.D. at 5%	12.11	1.01	5.51	0.81	0.83
Mulching :					
M_1	185.50	23.88	50.08	49.36	78.66
M_2	180.67	20.96	47.97	46.62	73.91
M_3	174.31	17.34	45.67	43.91	69.62
M_4	169.46	16.08	43.50	53.62	60.76
S.Em.±	2.27	0.17	0.87	0.48	0.54
C.D. at 5%	6.46	0.47	2.48	1.37	1.53
Interactions	NS	**NS**	NS	NS	NS
CV (%)	6.41	8.47	2.47	4.21	2.53
General Mean	150.48	8.32	149.55	48.37	71.96

Main treatments: (F)
F_1:75 per cent RDF
F_2: 100 per cent RDF

Sub treatments: (I)
I_1: Irrigation at 60 per cent ET
I_2: Irrigation at 80 per cent ET
I_3:Irrigation at 100 per cent ET

Sub-Sub treatments: (M)
M_1: White over black
M_2: Silver over black
M_3: Complete black
M_4: Control (without mulch)

Table 2: Soil moisture and soil temperature as influenced by fertilizer levels, irrigation levels and colour plastic mulches in pigeonpea

Treatments	Soil moisture, %		Soil temperature, ^{0}C	
	At harvest		At harvest	
	At surface	At 10 cm depth	At surface	At 10 cm depth
Fertilizer levels :				
F_1	20.24	20.36	32.91	33.61
F_2	20.67	20.71	32.46	33.48
S.Em±	0.03	0.03	0.08	0.09
C.D. at 5%	0.19	0.16	NS	NS
Irrigation levels:				
I_1	20.15	20.21	32.96	32.96
I_2	20.50	20.63	32.68	32.68
I_3	20.72	20.76	32.41	32.41
S.Em.±	0.01	0.02	0.09	0.09
C.D. at 5%	0.04	0.06	0.31	0.31
Mulching :				
M_1	22.60	22.64	32.77	33.41
M_2	21.39	21.44	33.02	33.86
M_3	20.23	20.40	33.33	34.15
M_4	17.61	17.67	31.62	32.46
S.Em.±	0.04	0.05	0.14	0.02
C.D. at 5%	0.12	0.15	0.39	0.05
Interactions	NS	NS	NS	NS
CV (%)	0.85	1.11	1.78	1.11
General Mean	22.28	20.54	32.68	33.47

Main treatments: (F)
F_1:75 per cent RDF
F_2: 100 per cent RDF
I_3:Irrigation at 100 per cent ET

Sub treatments: (I)
I_1: Irrigation at 60 per cent ET
I_2: Irrigation at 80 per cent ET

Sub-Sub treatments: (M)
M_1: White over black
M_2: Silver over black
M_3: Complete black
M_4: Control (without mulch)

Table 3: Chlorophyll content, leaf area index, harvest index and total dry matter production of pigeonpea as influenced by fertilizer levels, irrigation levels and colour plastic mulches

Treatments	Chlorophyll content (%)	Leaf area index	Harvest index	**Total dry matter production** (g per plant)
Fertilizer levels :				
F_1	42.26	1.78	0.58	468.72
F_2	42.56	2.34	0.45	491.33
S.Em±	0.01	0.06	0.01	3.84
C.D. at 5%	0.03	0.36	0.03	14.69
Irrigation levels:				
I_1	40.51	1.84	0.31	427.08
I_2	41.78	1.91	0.43	453.67
I_3	44.95	2.43	0.49	483.83
S.Em.±	0.85	0.06	0.02	5.27
C.D. at 5%	2.36	0.20	NS	14.15
Mulching :				
M_1	46.19	2.66	0.48	492.78
M_2	43.84	2.26	0.39	463.33
M_3	41.29	2.04	0.28	427.22
M_4	38.32	1.27	0.22	402.78
S.Em.±	0.32	0.09	0.02	5.09
C.D. at 5%	0.96	0.25	0.06	16.11
Interactions	NS	NS	NS	**NS**
CV (%)	8.25	18.38	33.57	43.05
General Mean	42.41	2.06	0.28	26.53

Main treatments: (F)
F_1:75 per cent RDF
F_2: 100 per cent RDF
I_3:Irrigation at 100 per cent ET

Sub treatments: (I)
I_1: Irrigation at 60 per cent ET
I_2: Irrigation at 80 per cent ET

Sub-Sub treatments: (M)
M_1: White over black
M_2: Silver over black
M_3: Complete black
M_4: Control (without mulch)

Table 4: Crop yield parameters of pigeonpea as influenced by fertilizer levels, irrigation levels and colour plastic mulches

Treatments	Crop yield parameters			
	Pods per plant	Seeds per pod	Test weight (g 100 seeds^{-1})	Seed yield (kg ha^{-1})
Fertilizer levels :				
F_1	615.94	3.78	11.48	2001.48
F_2	698.88	3.91	12.55	2161.69
S.Em±	11.35	0.05	0.16	39.70
C.D. at 5%	35.29	0.17	0.50	119.16
Irrigation levels:				
I_1	596.93	3.96	11.40	2161.38
I_2	687.48	4.31	11.99	2295.51
I_3	721.32	4.96	14.29	2302.88
S.Em.±	10.39	0.06	0.12	15.88
C.D. at 5%	29.32	0.19	0.40	43.90
Mulching :				
M_1	787.18	5.14	13.41	2318.47
M_2	754.12	4.93	12.80	2217.37
M_3	696.12	4.47	12.49	2034.95
M_4	617.52	3.83	11.14	2001.57
S.Em.±	11.29	0.08	0.08	42.46
C.D. at 5%	32.34	0.19	0.22	121.95
Interactions	NS	NS	NS	NS
CV (%)	4.36	8.64	9.65	9.26
General Mean	319.91	3.94	9.36	3641.59

Main treatments: (F)
F_1:75 per cent RDF
F_2: 100 per cent RDF
I_3:Irrigation at 100 per cent ET

Sub treatments: (I)
I_1: Irrigation at 60 per cent ET
I_2: Irrigation at 80 per cent ET

Sub-Sub treatments: (M)
M_1: White over black
M_2: Silver over black
M_3: Complete black
M_4: Control (without mulch)

Conclusion

In the experiment effect of different levels of drip irrigation, fertigation and different levels of colour plastic mulches on growth and yield of pigeonpea was studied. Plant growth and yield increased with increase in fertigation levels, irrigation levels and use of white colour plastic mulches. Soil moisture at surface, soil moisture at 10 cm depth, soil temperature at surface and soil temperature at 10 cm depth also depicted higher values at higher levels of fertigation, irrigation and use of white plastic mulch. Water use efficiency and nutrient use efficiency increased with higher levels of fertigation, irrigation and use of white plastic mulch.

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