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Response of Irrigated Groundnut to Polythene Mulching on Broad Bed and Furrows during the Low Temperature Months in Nigeria

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***Abstract*—** *Experiments were conductedduring 2014-2015 and 2015-2016 dry seasons to evaluate the response of selected groundnut varieties to Polythene Mulching (PM) onBroad Bed and Furrows (BBF)in the Sudan Savanna of Nigeria.The treatments consisted of Polythene mulch vs without mulch (control) and four groundnut varieties,laid outin Split plot design with four replications. The result showed that polythene mulch positively and significantly influenced the phenological and physiological variables as well as the yield and yield component of groundnut.Plot withPM emergence at mean of 8 days earlier and attained days to 50% flowering and maturity 11 and 10 days earlier than the control.Polythene mulch had positive and significant effects on all of the phenological, growth and yield parameters (100 seed weight,Spad Chlorophyll Meter Reading, LAI and shelling percentage) of groundnut. These effects ranged from 5% advantage in Spad Chlorophyll Meter Reading at 40DAS to 29% at LAI 60DAS.Mean pod yield of the mulch treatments (3401 kgha^{-1}) was 39% higher than the control (2102 kgha^{-1}). Samnut-24 had highest pod yield of 4009 kgha^{-1}under the polythene mulch treatments. Polythene mulch also increased the haulm production by 26% over the control treatment (4775 vs 3505 kgha^{-1}). The experiment showed that it is possible to produce high groundnut pod and haulm yields using PM onBBFin the Sudan Savanna of Nigeria..*

***Keywords*—Broad Bed and Furrow, Groundnut varieties, Polythene Mulch, Temperature and Yield**

I. INTRODUCTION

Groundnut (*Arachis hypogaea.* L.) is leguminous crop that is grown in the moist and dry savanna zones of Nigeria.Groundnut is grows for its nut, oil and haulms, though the yield is low because of the several environmental factors especially moisture and temperature (Ravindra *et al.*, 1990; Karim, 1990 and Ntare *et al.*, 2001), weed management and diseases. The average yields of groundnut in Nigeria and most parts of West Africa are lower (903 kg ha^{-1}) than those in South Africa (2000 kg ha^{-1}), Asia (1798 kg ha^{-1}), or the rest of the world (1447 kg ha^{-1}) (FAOSTAT, 2015).Mulching is the practices of covering the soil to make more favorable conditions for plant growth, development and efficient production. It plays a paramount role for conserving the moisture in the soil profile for the success of groundnut production, which totally depends on the precipitation received before and during crop growth period. The practice of mulching has been widely used as a management tool in many parts of the world. It dampens the influence of environmental factors on soil by increasing soil temperature controlling diurnal/seasonal fluctuations in soil temperature (Yang *et al*., 2006; Lalitha *et al*., 2001). However, the effect varies with soils, climate and kind of mulch material used and the rate of application. Singh(1994) and Lalitha *et al*., (2001) stated that variation of the soil microclimate by mulching favors seedling emergence and root proliferations and suppress weed population. The surface mulch favorably influences the soil moisture regime by controlling evaporation from the soil surface, improves infiltration, soil water retention, decreases bulk density and facilitates condensation of soil water at night due to temperature reversals (Yang *et al*., 2006; Pawar *et al*, 2004).

Broad Bed Furrow (BBF) is a method of cultivation by which farmers used to increase the density of groundnut population. Purcell *et al.* (2002) and Ball *et al*., (2000) reported that increasing plant density increased LAI and light inception of soybean which significantly increased soybean production, this is in agreement with findings of Ajeigbe *et al*, (2016) whoreported that increasing density in groundnut led to increase in high leaf area index (LAI) and the fraction of intercepted photosynthetic active radiation and high pod yield. Broad Bed and Furrow have been practiced in some parts of China and India for many decades to increase their groundnut productivity particularly during post-rainy season.

Many researchers (Sun *et al*., 2015 and Malekar *et al*., 2011) conducted researches to determine the effect of polythene mulch on groundnut production. These studies showed that the application of mulch increased pod yield of groundnut in comparison withcontrol groundnut. The major reason for mulch raising groundnut yield are soil and water conservation, improved soil physical and chemical properties and enhanced soil biological activity (Yang et al., 2006). ICRISAT and it National partners in Nigeria are encouraging the cultivation of groundnut for seed, grain and fodder under irrigation in the Sudan savanna zone during the dry season. During this period temperature is generally low compared during the beginning of the dry season in Nigeria With the advent of this technology, the core objective of the present studies was to investigate the response of irrigated groundnut varieties to polythene mulch during the low temperature months in the Sudan savanna of Nigeria.

II. MATERIALS AND METHODS

2.1 Description of the Experimental Site

Theirrigated experiments were conducted at ICRISAT experimental station in Wasai situated at (Latitude 12.14^0N and Longitude 08.67^0E with an elevation of 441 above sea level), Minjibir local government area of Kano State, Nigeria during 2014-2015 and 2015-2016 dry seasons (Late December when the temperature was cold). The study area has a Semi-arid climate with mean annual rainfall of 862.8mm in 2014 and 564.8mm in 2015 with peak rain around August for the both years. The minimum and maximum mean temperature during the experiment in 2014–2015 and 2015–2016 are given in figure (1). The soil texture is loamy sandy with pH of 6.54 and organic carbon of 0.219.

2.2 Field management and Experimental Design

The soil was ploughed two times to ensured removal of some noxious weeds and stumps that might cause damages to polythene mulch and planked to get a fine seedbed. After the seedbed preparation, pre-emergence herbicide (Pendimenthaline@3Lltrs/ha) was sprayed followed by application of basal fertilizer Single Super Phosphate (SSP) @100kg/ha and Gypsum at@400kg/ha prior to sowing, the seeds of groundnut cultivars were treated with Apron star @10g/4kg of seed and sown immediately.

The experiment was a Split plot designed with four replications. The mulching (white polythene mulch or control) was the main plot while the groundnut varieties (Samnut 23, Samnut 24, Samnut 26 and Ex-Dakar) were the sub-plot. Each plot consisted of 4 beds, each single bed measured in 4m length by 1m wide alternated with 0.25m furrow ($20m^2$).To effect the mulching treatment, 7 microns white polythene mulch having holes of 20 × 20cmhexagonal spacing was spread on the broad bed prior sowing. While the control (without) plots were conducted on the bare BBF. Sowing was done on 24^{th} of December 2014 repeated same date in 2015 by dibbling 2 seeds per hole at 5cm depth. Care was taken to ensure uniform depth of planting.Irrigation was administeredtwice a week for the first two weeks and there after it was observed once a week. Plots were regularly observed for good agronomic control (weeding where necessary) during the life period of the crop.Harvesting was done when thegroundnut varieties attained their physiological maturity.

2.3 Sampling and Measurement

Observations on plant growth were measured at 40, 60 and 80 DAS. Parameters such as SPAD chlorophyll meter reading (SCMR) and Leaf area index (LAI) leaf area index was also measured with the Ceptometer (AccuPAR PAR/LAI Ceptometer Model LP-80), at 12:00h noon prior irrigation.Fully expanded third tetrafoliate leaf from the apex of the main axis on all the five sampled plants was used to record SCMR. Care was taken to ensure that the SPAD meter sensor fully covered the leaf lamina and the interference from veins and midribs was avoided.

Germination percentage was recorded at 8, 15 and 30 DAS while the destructive sampling was carried out at 15days interval from 30 DASuntilharvest. For biomass fresh weight, 5 plants were randomly selected in 2 border rows of each plot, the root system having soil particles were thoroughly cleaned, weighed on electronic digital balance with precision of 0.1g and kept in the paper bags. The Samples were oven-dried for 48 hours at 70^0C and the final weight was taken. Data was recorded on plot basis for days to first flowering, 50% flowering(number of days from sowing to when at least 50% of the plants had begun flowering), pod yield and haulm yield and converted to kg ha^{-1}using conversion factor. Groundnut was harvested from the net plot avoiding the border rows when at least 80% of the plant has attained their physiological maturity (Days to maturity), pods were stripped and air-dried for the determination of the yield and its components. Weight of dry haulms after 1 week of air-drying was recorded. Pods were shelled and 100-g matured pods were used to estimate 100-seed weight (g) and shelling percentage. GENSTAT 17^{th} Edition was used to analyze for Split plot design and means were compared by using Least Significant Difference (LSD) test. Data recorded on different parameters were subjected to Analysis of variance (ANOVA) techniques to find out the different between the treatments and their interactions.

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III. RESULTS

Figure1 shows theaverage monthly minimum and maximum temperature during the experimental period. The average monthly minimum temperature ranged from 12.3ºC at planting to 25ºC at harvest while average monthly maximum temperatures ranged from 27ºC at planting to 41ºC at harvest. Planting was done during the cold months and harvest done during the hot months.

The means square from the analysis of variance (ANOVA) for germination percentage at 8, 15 and 30 DAS, days tofirst, 50% flowering and physiological maturity are presented in Table (1a).Significant differences were observed between the years for germination percentage at 30 DAS, days to first and 50% flowering. Polythene mulchand varieties (V) have significant effect on germination percentage at 8, 15 and 30 DAS, days to first and 50% flowering and days to physiological maturity, though the varieties did not differ for germination percentage at 8 DAS. The Year (Y) × Mulch (M)interaction was significant for germination percentage at8 and 15 DAS, days first and 50% flowering. The Y×V interaction was significant for germination percentage at15 and 30 DAS, days to first and 50% flowering and days to physiological maturity.While no significant M×V interaction were foundat all the germination stages, significant M×V interaction were found for days to first flowering, 50% flowering and days to physiological maturity. The Y×M×Vinteraction was significantonly for days to flowering.

Table 1b, shows the analysis of variance of combined mean squaresfor the yields and yield attributes. Polythene mulch and groundnut varieties had significant effect on pod and haulm yields as well as on 100 seed weight and shelling percentage. Y×M interaction was significant for haulm yield(kgha^{-1}) and 100 seed weight, while M×Vand Y×M×V interactions were significant for pod yield.

Table 1c, shows the combined mean squares for analysis of variance of physiological parameters. Year and groundnut varieties have significant effect only on LAI at 40 DAS. Polythene mulch had significant effect on chlorophyll content at 40, 60 and 80 DAS, and LAI at 40 and 60 DAS. Significant Y×M interactions were observed for chlorophyll content at 40, 60 and 80 DAS, and LAI at 40, while significant M×V and Y×M×V interactions were observed forchlorophyll content.

Table 1d shows the combined mean squares for analysis of variance of dry matter weight from 30 DAS to harvest. Significant differences were observed in dry matter weight at 30, 60, and 75 DAS and non-significant at 45, 90, 105, 120 DAS and harvest between the year of experiment conducted. Polythene mulch significantly influenced the dry matter weight from 30 DAS to harvest. Variety showed significant differences in all intervals except for 120 DAS and at harvest. All interactions were not significant except for dry matter weight at 60 DAS in Y×V and 30 DAS in M×V.

The effect of mulch on selected phenology, growth and yield characters of irrigated groundnut in the cool dry season in the Sudan savanna of Nigeria is given in table 2. Mulched plots recorded higher mean % germination at 8, 15 and 30 DAS (27, 51, 70% respectively) than control plots (0, 25 and 63% respectively). Mulched plots recorded higher mean days to first and 50% flowering and physiological maturity (31, 35, 134% respectively) than control plots (38, 46 and 144% days respectively). Mean pod (3401 kg/ha) and haulm (4775 kg/ha) yields, 100 seed weight (36 g) as well as shelling percentage (72%) of the mulched plots were significantly higher than the control plots (2102 kg/ha, 3505 kg/ha, 34gand 67% respectively). Also mean SCMR at 40 (37.9), 60 (44.35) 80DAS (50.03), mean LAI at 40 (1.32), and 60 (3.3) were significantly higher than control plots. However mean LAI at 80 DAS (4.43) on mulched plot was not significantly higher than mean LAI at 80 DAS (4.08) of control plots.The SPAD Chlorophyl Meter Reading (SCMR) was higher in polythene mulch treatment than controlat all the observation stages (Table. 2).

Table 3. Shows the interaction between polythene mulch and variety treatments on pod yield (kgha^{-1}). A significant interaction was observed for pod yields. Though all varieties positively responded to polythene mulch, the extent of response varies significantly. Samnut 24 produced the highest pod yields (4009 and 2261 kgha^{-1} mulched and control respectively), while Ex-Dakar produced the lowest pod yields (2906 kgha^{-1}) under mulched condition though Samnut 23 produced the lowest pod yields (1986.8kgha^{-1}) in the control. The polythene mulch increases pod yield increase by 30% in Ex-Dakar to 44%.

Fig. 2. Illustrate the effect of polythene mulch on dry matter weight of groundnut. The comparative percentage values between the mulched area and control for the dry matter weight were 67%, 50%, 45% 59%, 60%, 63%, 67% and 69% at 30 DAS to harvest respectively. The maximum dry matter weight was still achieved at the harvest.

IV. DISCUSSIONS

The first germination was observed at 8 DAS in mulch treatment as compared to control (without mulch) at 15 DAS indicating 7 daysdifference. The earlier germination under mulched condition (8 days) could be attributed to prevailing higher soil temperature as a result of heat entrapment by the polythene mulch, and moisture conservationby the polythene filmcompared to the cold stress by lower diurnal range of soil temperature experienced by the control causing the seeds to emerge in 15 days. At 30DAS, germination percentage was also discovered to show some disparity in phenological development (onset flowering R1 and pegging R2)between the mulched and control. Temperature is one of the key benefits of mulching in groundnut production. It was reported that soil temperature lower than 18^0C reduces germination and crop growth and temperature higher than 37^0C during pod development restricts pod and kernel growth resulting in lower pod yield (Reddy *et al*., 2003). After 30 days of planting, the plants under mulched treatment flowered earlier before control due to initial temperature stress experienced by plants in controlplot. Hence, given the groundnuts under mulched better chance for yield increment.

The results revealed in the current study indicated that days to first and 50% flowering and maturity were significantly lower (7, 11 and 10 days respectively) under polythene mulching indicating that the groundnut did not recover from late germination and flowering. The response of varieties under mulched treatment matured earlier due to higher photosynthetic rate on account of high mean soil temperature, sufficient moisture, less competition with weeds, functional microbial activities, and undisturbed soil structure coupled with nutrients availability beneath the mulch thereby shortens the crop duration. Polythene mulch had positive and significant effects on all of the phenological, growth and yield parameters (100 seed weight,Spad Clorophyl Meter Reading, LAI and shelling percentage) of groundnut. These effects ranged from 5% advantage in Spad Clorophyl Meter Reading at 40DAS to 29% at LAI 60DAS.Disparity in dry matter accumulation could be due to differences in the germination percentage, leaf area production and leaf area index. Bolaji *et al*., (2015) reported that LAI showed positive correlation with the dry matter accumulation. Likewise decrease in weed competition for limited resources in treatments that had higher dry matter weight and sufficient moisture under mulched which continued to act as substrate for other biochemical reaction which might have stimulated stronger carbohydrates sinks via photosynthesis. Zagade *et al*., (2006) also observed higher dry matter weight in treatments, where effects of polythene mulch, moisture regimes and plant densities were practiced on groundnut in Ratnagiri.Greater SCMR in treatments showed that the effect of mulching could include higher photosynthetic rate on account of sufficient moisture, light, and adequate nutrients uptake. Singh (2004) observed that photosynthetic rate of leaves in groundnut reduces as relative water content and water potential decreases.

Mean pod yield of the mulch treatments (3401 $kgha^{-1}$)was 39% higher than the control (2102 $kgha^{-1}$). Similar findings were reported by Hu, *et al*., (1995) and also in agreement with Zagade *et al*., (2006). The mean pod yields(2752 $kgha^{-1}$) obtained in this trial is much higher than mean yield (2067 $kgha^{-1}$) obtained in same location by Ajeigbe *et al*., (2016)under a population of 133,333 hill ha^{-1}. However the mean yields of the polythene mulched plots (3401 $kgha^{-1}$) was 40% higher the mean yield obtained by Ajeigbe *et al*., (2016). These differences can be attributed to the higher population in the polythene mulch trial (250,000hill ha^{-1}). It is also in agreement with Ajeigbe *et al*., (2016) who recommended higher plant population for groundnut production in the Sudan savanna zone of Nigeria. Groundnut haulm is a very important commercial product of dry season groundnut cultivations. The haulm comes at the peak of dry season when fodder cost is also at its peak. The groundnut haulms is therefore as important as pod to the farmers overall productivity. Polythene mulch increased the haulm production by 26% over the control treatment (4775 vs 3505 $kgha^{-1}$). This is a significant increase in the income of farmers as well as important in the crop-livestock integration continuum. Among the tremendous challenges facing Sub Saharan Africa agriculture is the need to generate a sustainable food and feed supply to match the expected high demand without destroying the natural resource base. Technologies like the polythene mulch and broad bed cultivation of groundnut in the dry season is a good option not only to increase production of quality legume fodder for livestock but to also break the cereal-cereal (rice-wheat) cycles normally foundin the irrigated schemes and Fadama in Sudan Savanna zone of Nigeria.

V. CONCLUSION

Polythene Mulching on Broad Bed and Furrows is recommended cultivation technology for dry season production in the Sudan Savanna of Nigeria,since it increase both the pod and haulm yields. The system also have additional advantage of increased water use efficiency because of conservation of moisture by the mulch as well as reduced cost on weeding since the polythene mulch reduced weed germination and emergence. It was also noticed that even when polythene mulch is not used, the Broad Bed and Furrows offer advantage of yields over the traditional cropping pattern in the area. Samnut 24 is the highest yielding of the tested varieties and is recommended for cultivation, though Samnut 26 and Samnut 23 also produced appreciable pod and haulm yields and can be used when Samnut 24 is not available.

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Table.1a:Combined mean squares from the analysis of variance for Phenology on groundnut in 2014 and 2015 dry season at Minjibir LGA of Kano state, Nigeria.

Source of variation	d.f	Germination (%) at 8 DAS	Germination (%) at 15 DAS	Germination (%) at 30 DAS	Days to first flowering	Days to 50% flowering	Days to maturity
Replication	3	54.69	411.1	237.70	0.1875	0.7292	1.792
Year (Y)	1	1255.26^{ns}	273.0^{ns}	3595.31*	33.063**	42.250**	1.000^{ns}
Mulch (M)	1	11564.65**	10626.7**	754.10*	715.563**	1660.563**	1521.0**
Variety (V)	3	242.70^{ns}	2162.7**	2361.46**	19.271**	32.687**	24.667**
Y.M	1	1255.26*	7608.5**	153.33^{ns}	45.563**	30.250**	4.000^{ns}
Y.V	3	50.69^{ns}	1770.2**	2173.89**	1.6042*	8.458**	7.000*
M.V	3	80.90^{ns}	13.1^{ns}	40.94^{ns}	10.188**	3.020**	11.000*
Y.M.V	3	50.69^{ns}	31.7^{ns}	135.78^{ns}	2.521**	2.792**	2.000^{ns}
Residual	36	32.89	112.2	92.57	0.2847	0.3229	1.792
Total	63						

*Significant at 5% probability level, **Significant at 1% probability level, ^{ns}: Non significant

Table.1b: Combined mean squares from the analysis of variance for yield and yield attributes of groundnut in 2014 and 2015 dry season at Minjibir LGA of Kano state, Nigeria

Source of variation	d.f	Pod yield ($kgha^{-1}$)	Haulm yield ($kgha^{-1}$)	100 Seed weight (g)	Shelling percentage (%)
Replication	3	454445.0	310282.0	1.658	13.422
Year (Y)	1	138337.0^{ns}	470510.0^{ns}	27.040*	26.904^{ns}
Mulch (M)	1	26997045.0**	25803225.0**	60.062*	435.227*
Variety (V)	3	1234611.0**	4629208**	199.720**	32.176*
Y.M	1	121974.0^{ns}	3451467*	31.360*	1.327^{ns}
Y.V	3	2300.16^{ns}	421982^{ns}	0.971^{ns}	13.239^{ns}
M.V	3	534924.0*	224358^{ns}	2.500^{ns}	12.612^{ns}
Y.M.V	3	323886.0*	52288^{ns}	1.445^{ns}	7.281^{ns}
Residual	36	104142	203847	4.474	5.429
Total	63				

*Significant at 5% probability level, **Significant at 1% probability level, ^{ns}: Non significant

*Table.1c: Combined mean squares from the analysis of variance for SCMR and LAI at 40, 60, and 80 DAS of groundnut varieties in 2014 and 2015 dry season at Wasai, Minjibir LGA of Kano state, Nigeri***a.**

Source of variation	d.f	SCMR at 40 DAS	SCMR at 60 DAS	SCMR at 80 DAS	LAI at 40 DAS	LAI at 60 DAS	LAI at 80 DAS
Replication	3	13.617	11.860	30.00	0.01683	0.2802	1.1170
Year (Y)	1	0.375^{ns}	40.641^{ns}	14.92^{ns}	1.57816*	1.0379^{ns}	0.1089^{ns}
Mulch (M)	1	61.819*	165.122*	293.69*	1.12625*	15.0059*	1.9252^{ns}
Variety (V)	3	3.645^{ns}	10.787^{ns}	10.66^{ns}	0.24548*	0.0730^{ns}	1.7495*
Y.M	1	76.781*	329.423**	243.75*	1.08941*	1.2572^{ns}	0.7788^{ns}
Y.V	3	5.152^{ns}	7.837^{ns}	5.46^{ns}	0.22684*	0.3480^{ns}	0.0979^{ns}

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M.V	3	24.357*	7.596^{ns}	4.98^{ns}	0.01783^{ns}	1.0174^{ns}	0.6195^{ns}
Y.M.V	3	20.213*	13.964^{ns}	6.47^{ns}	0.11732^{ns}	0.2480^{ns}	0.0547^{ns}
Residual	36	5.445	9.269	13.06	0.07340	0.3769	0.3086
Total	63						

*Significant at 5% probability level, **Significant at 1% probability level, ^{ns}: Non significant, SCMR= SPAD Chlorophyll meter reading, LAI= leaf Area Index

TABLE.1d: Combined mean squares from the analysis of variance for Dry matter weight (g) from 30 DAS to harvest of groundnut varieties in 2014 and 2015 dry seasons at Wasai, Minjibir LGA of Kano state, Nigeria.

Source of variation	**d.f**	Dry matter weight (g) at 30 DAS	Dry matter weight (g) at 45 DAS	Dry matter weight (g) at 60 DAS	Dry matter weight (g) at 75 DAS	Dry matter weight (g) at 90 DAS	Dry matter weight (g) at 105 DAS	Dry matter weight (g) at 120 DAS	Dry matter weight (g) at harvest
Replication	3	0.68266	22.401	35.22	989.7	380.9	1467.0	6960.0	6522.0
Year (Y)	1	0.87891*	110.513^{ns}	5187.60*	9530.6*	10251.6^{ns}	885.0^{ns}	47579.0^{ns}	36577.0^{ns}
Mulch (M)	1	17.32641**	558.731**	4928.04*	9433.3*	40804.0*	70623.0*	150253.0*	136161.0*
Variety (V)	3	1.16516**	41.353*	329.70*	1884.1*	5622.2**	4970.0*	6226.0^{ns}	6968.0^{ns}
Y.M	1	0.15016^{ns}	0.238^{ns}	691.69^{ns}	1.3^{ns}	441.0^{ns}	856.0^{ns}	24219.0^{ns}	11556.0^{ns}
Y.V	3	0.24641^{ns}	13.636^{ns}	264.23*	330.7^{ns}	770.4^{ns}	2293.0^{ns}	3808.0^{ns}	2828.0^{ns}
M.V	3	0.58057*	8.701^{ns}	4.70^{ns}	201.9^{ns}	376.8^{ns}	239.0^{ns}	5129.0^{ns}	5503.0^{ns}
Y.M.V	3	0.06432^{ns}	8.698^{ns}	14.88^{ns}	107.8^{ns}	87.8^{ns}	807.0^{ns}	2757.0^{ns}	1001.0^{ns}
Residual	36	0.09953	7.889	50.99	287.8	526.1	1582.0	3725.0	3509.0
Total	63								

*Significant at 5% probability level, **Significant at 1% probability level, ^{ns}: Non significant

Table.2: Effect of Mulch on selected Phenology, Growth and Yield Characters of Groundnut

Treatments	**Mulched**	**Control**	**F-Probability**	**LSD**
Percentage germ (%) at 8 DAS	27	0	**<.001**	6.01
Percentage germ (%) at 15 DAS	51	25	**<.001**	5.55
Percentage germ (%) at 30 DAS	70	63	**0.005**	3.86
Days to first flower	31	38	**<.001**	0.197
Days to 50% flower	35	46	**<.001**	0.3
Days to maturity	134	144	**<.001**	0.819
100 Seed weight (g)	36	34	**0.003**	0.977
Shelling percentage (%)	72	67	**0.001**	2.26
SCMR at 40 DAS	37.9	35.9	**0.042**	1.87
SCMR at 60 DAS	44.35	41.13	**0.005**	1.845
SCMR at 80 DAS	50.03	45.74	**0.021**	3.389
LAI at 40 DAS	1.32	1.05	**0.037**	0.243
LAI at 60 DAS	3.3	2.33	**0.003**	0.4766
LAI at 80 DAS	4.43	4.08	**0.084**	0.411
Pod yield (kg/ha)	3401	2102	**<.001**	125.88
Haulm yield (kg/ha)	4775	3505	**<.001**	400.6

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Table.3: Interaction effect of PM and variety on maturity and pod yield (kg/ha)

Variety	Pod yield (kg/ha)		
	Mulched	**Control**	**%Reduction**
Ex-Dakar	2906	2043	30
Samnut 23	3346	1987	41
Samnut 24	4009	2261	44
Samnut 26	3343	2116	36
Mean	3401	2102	37
F-Probability	**0.005**		
LSD	**300.55**		

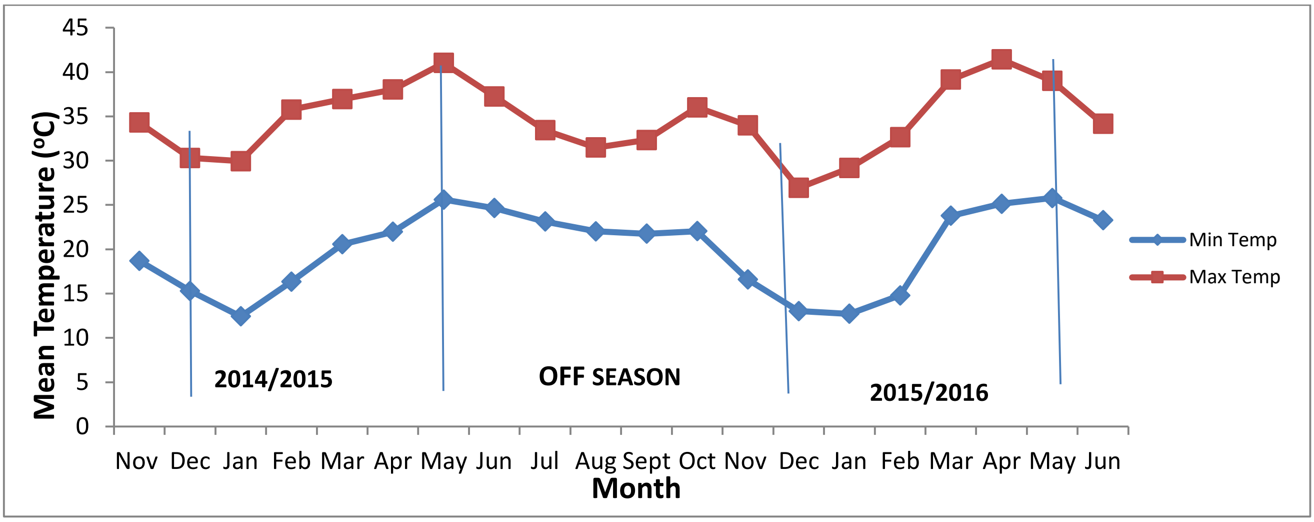

Fig.1: Monthly Minimum and Maximum Mean temperature during the experiment 2014–2015 and 2015–2016

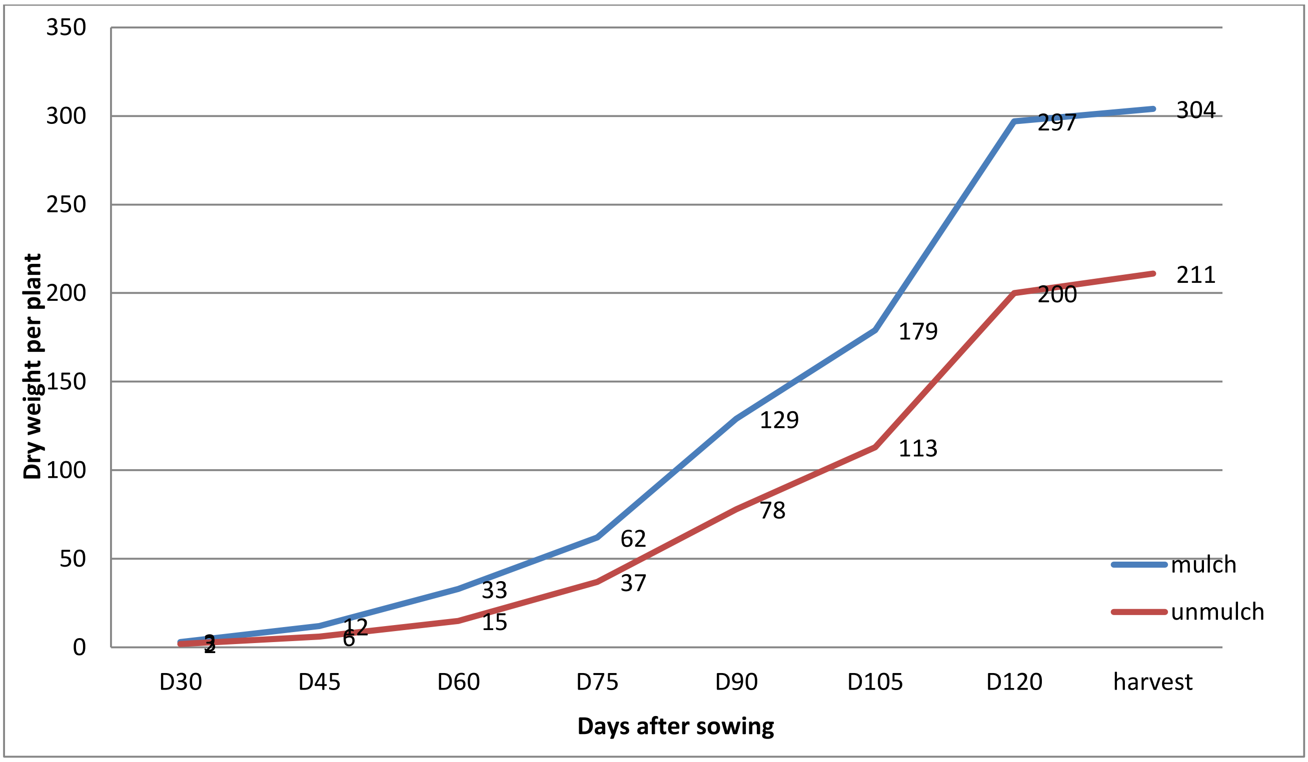

Fig.2: Effect of Polythene mulch on Dry matter weight of groundnut