The Pharma Innovation Journal 2023; 12(9): 2597-2604

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(9): 2597-2604

www.thepharmajournal.com
Received: 11-07-2023
Accepted: 18-08-2023

Shinde RS
Department of Agronomy, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

Mahadkar UV
Department of Agronomy, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

Jagtap DN
Department of Agronomy, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

Corresponding Author:
Shinde RS
Department of Agronomy, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

Influence of stress irrigation levels, fertigation levels with different type of mulches on yield, yield attributes, quality and economics of groundnut (*Arachis hypogaea* L.)

Shinde RS, Mahadkar UV and Jagtap DN

Abstract
An experiment conducted on "Effect of different levels of irrigation and fertilizers through drip irrigation coupled with different type of mulches on growth, yield and quality of groundnut in Konkan region" during *Rabi* 2018-19 and 2019-20 at Instructional Farm, Department of Agronomy, College of Agriculture, Dapoli, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra (India). The strip split plot experimental design which comprises three irrigation levels *viz.*, I_1 (60% ETc), I_2 (80% ETc) and I_3 (100% ETc) based on climatological approach in main plot and irrigation treatment given at every alternate day in sub-sub plot consist three levels of fertigation *viz.*, F_1 (80% RDF water soluble fertilizer(WSF), F_2 (100% RDF (WSF) and F_3 (120% RDF (WSF) and in sub sub plot with three different type of mulches M_1 (no mulch), M_2 (Silver polythene mulch) and M_3 (Transparent mulch). On the basis of results, for obtaining higher yield parameters, yield, quality as well as economic returns, from *rabi* groundnut in Konkan region groundnut crop should be irrigated with 100% ETc through drip with 100% RDF under silver polythene mulch.

Keywords: Fertilizer levels, ground nut, irrigation levels, mulches, quality and yield

Introduction
Groundnut is important oilseed crop in India. Its contain high quality of 45-50% edible oil, 20-25% protein, carbohydrates, and 5% fiber and ash which contribute for human nutrition (Fageria *et al.* 1997) [7]. Groundnut grown in India over 4.88 million ha area with total production of 9.25 million tonnes with average productivity of 18.93 qha^{-1} (Indiastat, 2017-18) [9]. The area across the country is fluctuation due to crops dependence on rainfall. Nine oilseed crops primarily grown in India out of them groundnut and rapeseed-mustard are the two oilseed that dominate the edible oil economy of the country, contributing about 66% of production. About 90% of the oilseed grown in India is under uncertain and abnormal weather conditions." Uneven distribution of rainfall, irregular rains and insufficient and alternate irrigation sources at crop maturity largely impact on final yield. In Maharashtra, groundnut cultivated over an area of 291thousand ha with production of 344.32 thousandtonnes and having productivity of 1183 kg ha^{-1} (Indiastat2017-18) [8]. The area under groundnut crop in Konkan region 3.3 thousand ha area of groundnut with 71 thousand tonne production and average productivity 2245 kg ha^{-1}. In Konkan Sindhudurg district having high productivity 2245 kg ha^{-1} while the lowest productivity in Ratnagiri district that is 1303 kg ha^{-1} (Anonymous 2018-2019). In the Konkan region, receives about 3000 to 3500 mm precipitation annually during monsoon. However, immediately after the monsoon *i.e.* may be after month of February there is scarcity of water during *rabi* season to irrigate the fields. Mono cropping *i.e.* paddy cultivation is the common practices in Konkan region. The soil is lateritic and well drain. The area under irrigation in Konkan is not crossing 7.6% of the total cultivable area and very merger area is under micro irrigation. There is vast scope to introduce cash crops like groundnut along with other crops in *rabi* season. There is urgent need to utilize the scare water resources like line farm ponds, wells and bore wells etc. judiciously and precisely by using the micro irrigation *i.e.*, drip irrigation through which fertigation can be done. Utilization of applied fertilizer is depending upon proper method, time and amount of fertilizer application at proper stage of crop to avoid loss of applied fertilizers. Hence, application of fertilizer through irrigation by using water soluble fertilizer is very crucial for better growth which avoids loss of fertilizer through handling. Fertilizers directly applied near root zone of the crop by means of

fertigation with maximum split application is possible by availing drip irrigation system due to that increase yield 25-30% and saving of fertilizer is up to 25-30% with saving time and labour cost of applied fertilizer. Advantages of precise and equal distribution of fertilizers throughout the field can be obtained through fertigation. Mulch alter soil temperature by increasing soil temperature when atmospheric temperature is low. Mulching is highly helpful in crop production with minimalized soil moisture transpiration losses, supress weed growth, helps for maintaining optimum soil temperature collectively helps for saving applied irrigation water. Mulch play vital role for increase in soil microbial activity by maintaining optimum soil temperature. Keeping in view the above facts, the experiment entitled, "Effect of different levels of irrigation and fertilizer through drip irrigation coupled with different type of mulches on growth, yield and quality of groundnut in Konkan region" was carried out at Agronomy Farm, College of Agriculture, Dapoli during *Rabi* season of 2018-19 and 2019-20.

Materials and Methods

"The trial conducted to assess the, "Effect of different levels of irrigation and fertilizers through drip irrigation coupled with different type of mulches on growth, yield and quality of groundnut in Konkan region" was conducted during *Rabi*season 2018-19 and 2019-20 at, Department of Agronomy, College of Agriculture, Dapoli, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra (India)." Soil of the experimental plot was sandy clay loam in texture, medium in available nitrogen and high in potassium phosphorous, soil was slightly acidic in nature and very high in organic carbon. The experimental site is situated at 17º 45' N to 20º 22' N latitude and 73º10' E to 73º48' E longitude and altitude of 250 meter above the mean sea level.The strip split plot experimental design which comprises three irrigation levels *viz.*, I_1 (60% ETc), I_2 (80% ETc) and I_3 (100% ETc) based on climatological approach in main plot and irrigation treatment given at every alternate day in sub-sub plot consist three levels of fertigation *viz.*, F_1 (80% RDF (WSF), F_2 (100% RDF (WSF) and F_3 (120% RDF (WSF) and in sub plot with three different type of mulches M_1 (no mulch), M_2 (Silver polythene mulch) and M_3 (Transparent mulch), used 7 micron thickness mulch and make holes with the help of punching by maintaining three rows on each bed with spacing 20 cm x 10 cm. Konkan bhuratna variety of groundnut was used with fertilizer dose 25:50:00 NPK kg $ha^{-1}$and one common pre sowing irrigation of 60 mm depth was applied to each bed to ensure good germination.Fertilizer was applied as per treatment with using water soluble fertilizer *viz*., 12:61:00 and Urea into 12^{th} equal split doses. There were total 27 treatment combinations which was replicated thrice to get unbiased and correct data. The broad bed furrows top width maintain 60 cm were laid out in the experimental plot with the help of tractor drawn ridge and thereafter one lateral was laid down in the centre of each bed. For calculating crop evapotranspiration (ETc) used formula ETc = ETo x Kc. ETo was calculating by using daily weather data which was received from agro meteorology section Department of Agronomy, Dr. BSKKV, Dapoli and Kc values distributed 0.45 for initial stage (25 days), 0.75 crop development stage (35 days), 1.05 mid-season stage (45 days) and 0.70 late season stage (25 days) and irrigation was applied upto 130 days. The trial data were statistically analysed as per the method defined by Panse and Sukhatme (1985) [17].

Results and Discussion

Effect of irrigation levels

"The significantly highest number of pods $plant^{-1}$ was recorded due to treatment irrigation levels 100% ETc (I_3) 23.11 followed by 80% ETc (I_2) 19.14 and 60% ETc (I_1) 14.68 in that descending order. Irrigation level 100% ETc (I_3) was found superior over 60% ETc (I_1) but, remained at par with 80% ETc (I_2) during investigation, while lowest number of pods $plant^{-1}$ was noted due to 60% ETc (I_1)."

"Data presented in Table 1 reported that, significantly the highest weight of matured pod $plant^{-1}$ (g) was recorded due to irrigation level 100% ETc (I_3) was 30.62 g followed by irrigation levels I_2 and I_1 in that descending order of significance. Further, irrigation levels I_1 produced significantly the lowest weight $plant^{-1}$ (19.68 g).Weight of pods $plant^{-1}$(g) increased with increase in irrigation level up to 100% ETc (I_3). The improvement in the yield attributes might be due to available of adequate moisture and aerated condition in soil which made favourable condition for growth and development of crop. These findings are similar with Thorat (2000) [28] and Arif *et al.* (2016) [2]."

"Data indicate that, significantly highest seed index noticed due to irrigation level 100% ETc (I_3) was 51.36 which was remained at par with irrigation level 80% ETc I_2. However, the irrigation level (I_1) noticed significantly the lowest seed index which was remained at par with irrigation level 80% ETc (I_2). Highest 100 pod kernel weight (g) $plant^{-1}$ recorded due to treatment irrigation at 100% ETc during the study." This might be due to availability of optimum and most appropriate moisture condition in the root zone of the crop *i.e.* Moisture was closer to field capacity, therefore there was no moisture stress to the crop and well aerated soil conditions, which reflected in better physiological activity of plant and reflect into increased in yield attributes and yield of groundnut. These findings are in confirms with findings of Khonok *et al.* (2014) [12] and El-Habbasha *et al.* (2015) [6].

Dry pod yield q $ha^{-1}$of groundnut was influenced due to application of different irrigation levels. Irrigation at 100% ETc (I_3) recorded significantly, the highest dry pod yield over rest of the irrigation levels, followed by irrigation levels 80% ETc and 60% Etc. However, significantly the lowest dry pod yield was recorded with application of 60% ETc (I_1). Further, data revealed that, increase in dry pod yield due to irrigation levels I_3 and I_2 was to the tune of 26.05 and 15.46%, respectively over irrigation level 60% ETc (I_1).

Data mentioned in Table 1 revealed that, significantly the highest haulm yield produce due to irrigation level 100% ETc (I_3), which was significantly superior over remain irrigation levels. Irrigation level 60% ETc (I_1) recorded significantly the lowest haulm yield compared with others treatments. The significant increase in haulm yield over 60% ETc (I_1) due to treatment I_3 and I_2 was to the tune of 24.47 and 10.77%, respectively. Irrigation treatment 100% ETc produced significantly superior haulm yield q ha^{-1} over rest of remain treatments. Availability of optimum soil moisture along with the proper air and water ratio in the root zone resulted in to a better activity of soil micro flora which play important role for releasing plant nutrients and fulfilling nutrients requirement of crop. The development of congenial soil condition in case of irrigation level100% ETc resulted in higher haulm yield of groundnut. In addition to this, the

irrigation was scheduled at alternate day based on climatologically approach for maintaining the soil water levels almost near to the field capacity and crop did not experienced moisture stress during the crop growth period. Similar results were reported by El-Habbasha *et al.* (2015) [6], Arif *et al.* (2016) [2] and Kamble *et al.* (2018) [11].

The increase in crop yield with the increase in irrigation in level upto 100% ETc. Regarding the dry pod yield q ha^{-1} the application of irrigation at 100% ETc recorded significantly superior dry pod yield over rest of the treatments. pegging and early pod formation as well as pod formation to maturity stages are more crucial for moisture stress hence during these stages the crop supplied with sufficient moisture upto irrigation level 100% ETc (I_3) and hence groundnut produced higher yield while lowest yield was produce due to irrigation level 60% ETc (I_1).Same results were reported by Dabasree and Gunri (2014) [4], Khonok *et al.* (2015) [12] and El-Habbasha *et al.* (2015) [6], Arif *et al.* (2016) [2], Kamble *et al.* (2018) [11] and Ranjitha *et al.* (2018) [20].

The crop sown with irrigation level 100% ETc (I_3) produced maximum biological yield of 108.31 q ha^{-1} which was highest as compared with remain of the irrigation levels. This might be due to the beneficial effect of irrigation water that has resulted in accumulation of more biomass. These findings are in conformity with the earlier findings given by El-Habbasha *et al.* (2015) [6] and Arif *et al.* (2016) [2].

Quality parameters of groundnut like oil content and protein content in groundnut further supported the superiority of application of irrigation at 100% ETc over 80% ETc (I_2) and 60% ETc (I_1). It was observed from the data that the oil percentage was increased with increase in irrigation levels. Parallel results were stated by Naresha *et al.* (2018) [16].

Highest total cost of cultivation required for treatment irrigation level 100% ETc (I_3) which was ₹ 1, 54,550 ha^{-1}. The lowest cost for production estimate for irrigation levels (I_1) 60% ETc that of ₹ 1,46,090 ha^{-1}.

The maximum gross monetary returns were recorded due to irrigation levels 100% ETc (I_3) which was ₹ 2,42,938 ha^{-1}while lowest gross income was received due to treatment of 60% ETc ₹ 1,92,869 ha^{-1}which was associated with higher and lower groundnut yield, respectively. Same result was observed with Kamble *et al.* (2018) [11].

The highest net monetary returns were recorded due to the treatment irrigation at 100% ETc (I_3) which was 88,389₹ ha^{-1}while lowest net return was received due to irrigation treatment 60% ETc (I_1) ₹ 46,779 ha^{-1}which was associated with higher and lower groundnut yield, respectively. Similar kind of gross and net monetary return observed by Arif *et al.* (2016) [2] and Kamble *et al.* (2018) [11].

The maximum benefit cost ratio of 1.57 was obtained under highest irrigation level 100% ETc (I_1) while lowest B: C ratio 1.31was observed in irrigation level 60% ETc (I_1). These results are in line with those reported by Arif *et al.* (2016) [2] and Naresha *et al.* (2018) [16].

Effect of different levels of fertilizers

Yield of crop is a complex character. Different levels of nutrients apparently resulted in greater difference in growth and yield of groundnut. Many factors having direct or indirect impact on pod yield. The major factors which have direct comportment on final dry pod yield (g) $plant^{-1}$and total number of $podsplant^{-1}$, weight of pod (g) $plant^{-1}$, 100 kernel weight (Seed Index) and shelling percentage etc. which was influenced by different levels of fertilizers.

Data mentioned in Table 1 revealed that, fertilizer level 120% RDF (F_3) recorded significantly maximum pods $plant^{-1}$followed by F_2 and F_1.Application of 120% RDF found significantly superior over rest of the fertilizer levels. Fertilizer level 80% RDF recorded significantly the lowest number of pods $plant^{-1}$.

Different levels of fertilizer significantly influenced on the weight of matured pods (g) $plant^{-1}$. Significantly highest weight of pods (g) $plant^{-1}$wasobtaineddue toapplication120% RDF (F_3) that was 27.78 g which was superior over F_2 and F_1.While significantly the lowest weight of pods (g) $plant^{-1}$was noted due toF_1which was 22.55 g.

Seed index value was increased with increase in fertilizer levels. Significantly, the highest hundred seed weight (Seed Index) registered due to application of 120% RDF (F_3) that was 50.84 followed by F_2 50.12. While, the lowest seed index was noticed due to fertilizer levels 80% RDF (F_1) which was remained at par with F_2.

Higher number of pod $plant^{-1}$, weight of developed dry pod (g) $plant^{-1}$, 100 kernel weights, shelling percentage were recorded highest with application of 120% RDF while lowest yield attributing charters was noticed with lowest levels of fertigation. The improved yield due to application of drip fertigation helps for increasing nutrients availability near the root zone of crop throughout growing periods, which might be due to even distribution of applied nutrients through drip fertigation. Since, nutrient application through drip irrigation increased solubility and availability of nutrients as they were supplied 12 equivalent splits doses, thus reduce leaching losses of applied fertilizer and their ill effects on environmental. Parallel results were obtained by Sabina (1995) [22], Vijayalakshmi *et al.* (2011) [30] and Mathukia *et al.* (2014) [14].

Effective and better segregating of plant metabolites and well translocation and accumulation of photosynthates towards final plant produce along with carbohydrates, vitamins, amino acids, etc. for well developing reproductive structures under with well nutrient use efficiency helps for increased yield attribute characters. The drip fertigation creates encouraging circumstances for improving nutrients up take with boost plant growth leading to the development of yield attributes due to increment in photosynthates towards the reproductive plant parts of groundnut. Similar kind of results was observed by Shivakumar *et al.* (2014) [23], Verma *et al.* (2015) [29] Jain and Meena (2015) [10] and Soni and Raja (2017) [24].

Perusal of the data glimpse in Table 1 regarding dry pod yield (q) $ha^{-1}$of groundnut showed that, dry pod yield of groundnut was significantly increased due to different fertilizer level. Significantly, the highest dry pod yield (q) $ha^{-1}$was produced due to application of 120% RDF (F_3)which was found at par with 100% RDF (F_2). Significantly, the lowest dry pod yield was produced due to application of 80% RDF (F_1).It was observed that, increase in dry pod yield of groundnut over 80% RDF (F_1) due to fertilizer levels F_3 and F_2 was to the tune of 13.69 and 9.02%, individually.

Data in glimpse Table 1 revealed that, highest haulm yield was produced due toapplication120% RDF (F_3) which was found at par with 100% RDF (F_2). Significantly increase in haulm yield over 80% RDF (F_1) due to fertilizer levelsF_3 and $F_2$was to the tune of 8.10 and 4.82%, respectively.

Yield enhancement was predominantly related to proper management of nutrient and well uptake of nutrients. The

maximum pod yield produce due to high frequency of fertigation. Frequently provide of nutrients through drip irrigation helps for improving the uptake of nutrients through two main mechanisms, firstly constant replacement of nutrients in the depleted zone of root as well improved transportation of dissolved nutrients by mass flow, along with optimum water content in the medium. Due to frequently fertigation enables to reduce the concentrations P, K and trace metals in irrigation water. The results confirm the findings of Sabina *et al.* (1995) [22], Rathore *et al*. (2014) [21] and Jain *et al.* (2018) [9].

Oil and protein content (%) in groundnut were influenced due to application of different levels of fertilizers. Oil and protein content (%) were found increase with increased levels of fertilizers through drip application. Similar trend was also observed by Jain and Meena (2015) [10] and Jain *et al.* (2018) [9].

Application of highest fertilizer dose 120% RDF through fertigation recorded highest gross return (₹ 2,31,632 ha^{-1}), net return (₹76,963 ha^{-1}) and benefit cost ratio (1.49).Similar results was found by Jain *et al*. (2018) [9].

Effect of different type of mulches

Data glimpse in Table 1 shows that, silver polythene mulch (M_2) recorded significantly maximum number of pods $plant^{-1}$ that was 21.59 followed by M_3 and M_1 in that descending order of significance. M_2 showed superiority over M_1 and M_3. While, treatment no mulch (M_1) registered the lowest number of pod $plant^{-1}$that was 16.18.

Silver polythene mulch (M_2) produced significantly the highest dry pod weight $plant^{-1}$(g) was 28.92. Silver polythene mulch (M_2) followed by M_3 and M_1 in that descending order however, significantly the lowest weight of pods (g) $plant^{-1}$produceddue to treatment no mulch (M_1).

Data glimpse in Table 1 reported that, significantly the highest seed index was noticed due to silver polythene mulch (M_2) followed by $M_3$and M_1 in that descending order. Silver polythene mulch (M_2) registered 50.79 seed index. The lowest seed index was observed due to treatment no mulch (M_1).

Significantly higher yield attributing characters *viz.*, number of pods $plant^{-1}$, weight of pod (g) $plant^{-1}$ and kernel $plant^{-1}$, seed index, was recorded with silver polythene mulch over rest of the mulches during both the years of study. Groundnut under polythene mulch might have produced more root growth and the nutrient availability might have been more under polythene mulch due to favourable temperature regime and better microbial activity. Polythene mulch improves the microclimate by maintaining the temperature and CO_2 movement of the soil. Favourable microclimate enhances the population of microorganism which in turn increase the availability of nutrient to plant. All these increase the photosynthetic efficiency of crop. Due to this phenomenon higher number of pods $plant^{-1}$ and weight of pod $plant^{-1}$ was recorded in silver polythene mulch. Polythene film makes restriction for pegs development into the later subsequent growth stages for enter the soil, that helpful for saving nutrients for developing pods that already set earlier, increasing the number of filled pods and reducing the number of immature pods. Similar findings were reported by Subrahmaniyan *et al.* (2008) [26].

Glimpse of the data presented in Table 1 revealed that, dry pod yield (q) $ha^{-1}$was significantly influenced due to different type of mulches. Significantly maximum dry pod yield of groundnut obtained due to silver polythene mulch (M_2) 44.45 q ha^{-1}, which was superior as compared with other mulches, followed by transparent polythene mulch (M_3)which recorded 41.00 q $ha^{-1}$and No mulch(M_1) recorded 36.47q ha^{-1}in that descending order of significance. However, increase in dry pod yield over no mulch (M_1) due to silver polythene mulch (M_2) and transparent mulch (M_3) was to the tune of 21.88 and 12.42%, respectively.

The scrutiny of the data presented in Table 1 implies that, there was significant difference due to different type of mulches on haulm yield q ha^{-1}.Silver polythene mulch (M_2) produced significantly the highest haulm yield. Silver polythene mulch was obtained 60.17 q ha^{-1} followed by transparent mulch (M_3) 56.88 q ha^{-1} and No mulch (M_1) 53.47 q ha^{-1} in that descendant order of significance, further, significantly the lowest haulm yield was produced due to treatment M_1 over rest of the mulches. It was recorded that, the increase in dry pod yield over treatment no mulch (M_1) due to treatment M_2 and M_3 to the tune of 12.53 and 6.37%, respectively. Significantly higher dry pod yield was found due to silver polythene mulch over rest of the treatments during both the year of an experiment. It was 21.88% more over no mulch treatment and 9.46% over transparent mulch. Silver polythene mulch crop produced higher photosynthesis rate and chlorophyll content which help for formation of well-developed pods $plant^{-1}$ and finally into dry pod yield of groundnut. Similar result found by Sun *et al.* (2015) [27] silver polythene mulch sunlight reflected beck due to that crop plant gets better photosynthesis as compared to rest of mulches which helps into formation of better plant assimilates as source and finally converted into dry pod yield as a sink.

The optimum of soil moisture and temperature reduces evaporation losses due to treatment of polythene mulch which helps for greater nutrient uptake, well vegetative growth, helpful for built up more photosynthates, which has resulted into creation of more sink in the form of creating more yield attributes and finally conversion in dry pod yield was more in silver polythene mulch over rest of mulching might be due to better pod filling under unstressed environment of mulching. These findings are on similar line with findings of Domber *et al.* (2009) [5], Mane *et al*. (2010) [13], Bhure (2010) [3]. The favorable microclimate, soil micro-flora, improve soil structure, reduce fertilizer leaching, least evaporation and weed problems under silver polythene mulch which helps increase dry pod, haulm and kernel yield of groundnut under polythene mulch helps to increase in yield of groundnut under silver polythene much over rest of mulching reported by Sounda *et al*. (2006) [25] and Jain *et al*. (2018) [9]. Higher dry pod yield was obtained in silver polythene mulch. This might be due to less weed infestation was observed as compared to transparent mulch which create more competition for soil moisture, nutrients and light similar finding match with Sun *et al.* (2015) [27].

Silver polythene mulch recorded considerably superior biological yield over others treatments. This might be due to use of silver polythene mulch which create favorable micro-climate in the root zone of the crop. The favorable physical and microbial condition of soil, crop resulted in higher N, P, K uptake and growth of the crop. The higher amount of photosynthates produce by the crop under silver polythene mulch condition is evident from accumulation of more amount of biomass in the form of dry matter hence ultimately increase biological yield in comparison with other mulches.

As well as under mulch conditions creation of better availability of soil moisture and balance of soil temperature which lead to increase uptake of nutrients with in less time. As well as in polythene mulch prevented leaching of fertilizers due high rainfall with addition its reduction of weed competition under polythene mulch might have triggered the plant to use available resources more effectively due to same reason N, P, K uptake by crop plant similar results was reported by Subrahmaniyan *et al.* (2008) [26] and Jain *et al.* (2018) [9] in groundnut crop.

It was observed from the data that oil percentage, shelling percentage and protein content differed statistically due to different mulching treatments under study. This trend is in conformity with the earlier findings reported by Subrahmaniyan *et al.* (2010) [26]. Under silver polythene mulch groundnut oil percentage was found to increase by 1.13 percent over no mulch and 0.20% over transparent mulch treatment that authenticate the findings of Jain *et al.* (2018) [9].

The highest gross monetary returns was recorded due to use of silver polythene mulch which was ₹ 239382 ha^{-1} while low gross income was received due to treatment of no mulch ₹ 197426 ha^{-1}which was connected with higher and lower groundnut yield, individually. These results are in line with those reported by Gosavi (2006) [8], Kamble *et al.* (2018) [11].

The highest net monetary returns were recorded due to use of silver polythene mulch which was ₹83179 ha^{-1}while lowest net income was in the treatment no mulch₹55264 ha^{-1}which was associated with higher and lower groundnut yield, respectively. Similarly, the highest benefit cost ratio of 1.53 and lowest benefit cost ratio 1.38 with treatment no mulch. Similar findings reported by Gosavi (2006) [8], Pinjari (2007) [18], Jain *et al.*, (2018) [9] and Kamble *et al.* (2018) [11].

Economics of treatments combination

Data on the economics of the different treatment combinations in respect of groundnut are presented in Table 3 revealed that, the higher cost of cultivation of groundnut with treatment combination was observed with $I_3F_3M_2$ (Irrigation levels I_3-100% ETc + F_3-120% RDF + M_2-Silver polythene mulch) that was ₹ 165452 ha^{-1}followed by $I_2F_3M_2$ (Irrigation levels I_2-80% ETc+ F_3-120% RDF + M_2-Silver polythene mulch ₹ 163185 ha^{-1}) and $I_2F_2M_2$ (Irrigation levels I_2-80% ETc + F_2-100% RDF + M_2-Silver polythene mulch) ₹ 156071 ha^{-1}. While highest gross return (₹ 281827 ha^{-1}) with treatment combination $I_3F_3M_2$ (Irrigation levels I_3-100% ETc + F_3-120% RDF + M_2-Silver polythene mulch) followed by descending order with treatment combination $I_3F_2M_2$ (Irrigation levels I_3-100% ETc+ F_2-100% RDF + M_2-Silver polythene mulch) ₹ 275787 ha^{-1} and $I_2F_3M_2$ (Irrigation levels I_2-80% ETc + F_3-120% RDF + M_2-Silver polythene mulch ₹ 269077 ha^{-1}.

Highest net returns₹ ha^{-1}received with treatment combination $I_3F_3M_2$ (Irrigation levels I_3-100% ETc + F_3-120% RDF + M_2-silver polythene mulch) ₹ 116375 ha^{-1} followed with descending order by $I_3F_2M_2$ (Irrigation levels I_3-100% ETc + F_3-120% RDF + M_2-Silver polythene mulch) 113286₹ ha^{-1}followed by $I_2F_3M_2$ (Irrigation levels I_2-80% ETc+ F_3-120% RDF + M_2-Silver polythene mulch) ₹ 105892 ha^{-1}.

Benefit cost ratio (B: C ratio) with different treatment combination $I_3F_3M_2$and $I_3F_2M_2$ (Irrigation levels I_3-100% ETc + F_3-120% RDF + M_2 silver polythene mulch) and (Irrigation levels I_3-100% ETc + F_2-100% RDF + M_2-Silver polythene mulch) received same B: C ratio 1.70 followed by treatment combination $I_3F_3M_3$ (Irrigation levels I_3-100% ETc + F_3-120% RDF + M_2 silver polythene mulch) that is 1.60.

Table 1. Effect of different treatments on pooled yield attributes, yield and quality parameters.

Treatments	Number of pods plant^{-1}	Weight of mature pods plant^{-1}(g)	Seed Index	Dry pod yield (q ha^{-1})	Haulm yield (q ha^{-1})	Biological yield (q ha^{-1})	Kernel yield (q ha^{-1})	Shelling percentage (%)	Oil percentage (%)	Protein content (%)
Irrigation levels (Vertical strip)										
I_1- 60% ETc	14.78	19.68	49.32	35.70	50.86	86.50	24.41	68.23	49.52	20.67
I_2- 80% ETc	19.14	25.02	50.19	41.22	56.34	97.57	28.61	69.39	50.31	23.45
I_3- 100% ETc	23.11	30.62	51.36	45.00	63.31	108.32	31.64	70.24	50.62	25.53
S.Em.±	1.04	1.16	0.37	0.32	0.71	0.96	0.14	0.24	0.16	0.78
C.D. at 5%	4.09	4.56	1.46	1.25	2.78	3.78	0.56	0.96	0.62	3.06
Fertilizer levels (Horizontal strip)										
F_1- 80 % RDF (WSF)	17.03	22.55	49.92	37.77	54.48	92.19	26.03	68.78	49.84	20.74
F_2- 100% RDF (WSF)	18.99	24.99	50.12	41.18	57.11	98.29	28.55	69.21	50.24	23.25
F_3- 120% RDF (WSF)	21.02	27.78	50.84	42.98	58.92	101.90	30.08	69.87	50.37	25.66
S.Em.±	0.39	0.41	0.09	0.62	0.58	0.74	0.44	0.12	0.11	0.53
C.D. at 5%	1.52	1.60	0.35	2.44	2.29	2.89	1.74	0.48	0.43	2.08
Type of mulches (Split)										
M_1- No mulch	16.18	21.82	49.75	36.47	53.47	89.88	25.01	68.43	49.46	22.01
M_2- Silver polythene mulch	21.59	28.92	50.79	44.45	60.17	104.62	31.05	69.76	50.59	22.98
M_3- Transparent mulch	19.26	24.57	50.33	41.00	56.88	97.88	28.60	69.67	50.39	24.66
S.Em.±	0.35	0.54	0.17	0.45	0.54	0.74	0.32	0.19	0.15	0.49
C.D. at 5%	1.00	1.54	0.49	1.28	1.53	2.13	0.90	0.55	0.42	1.41
Interaction effect										
I x F										
S.Em.±	0.82	1.25	0.22	1.08	1.10	1.89	0.79	0.34	0.17	0.94
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

I x M										
S.Em.±	0.60	0.93	0.30	0.77	0.93	1.29	0.55	0.33	0.25	0.85
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
F x M										
S.Em.±	0.60	0.93	0.30	0.77	0.93	1.29	0.55	0.33	0.25	0.85
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
I x F x M										
S.Em.±	1.04	1.61	0.51	1.34	1.61	2.23	0.95	0.58	0.44	1.47
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
General mean	19.01	25.11	50.29	40.64	56.84	97.46	28.22	69.29	50.15	23.22

Table 2: Effect of different treatments on pooled cost of cultivation, gross returns, Net return and B:C Ratio of groundnut

Treatments	Cost of Cultivation	Gross return	Net Return	B:C Ratio
Irrigation levels (Vertical strip)				
I_1- 60% ETc	146090	192869	46779	1.31
I_2- 80% ETc	150813	222113	71300	1.47
I_3- 100% ETc	154550	242938	88389	1.57
Fertilizer levels (Horizontal strip)				
F_1- 80 % RDF (WSF)	145808	204184	58376	1.39
F_2- 100% RDF (WSF)	150976	222104	71128	1.46
F_3- 120% RDF (WSF)	154669	231632	76963	1.49
Type of mulches (Split)				
M_1- No mulch	142162	197426	55264	1.38
M_2- Silver polythene mulch	156203	239382	83179	1.53
M_3- Transparent mulch	153087	221112	68025	1.44
General mean	150484	219307	68822	1.45

Table 3: Pooledcost of cultivation (₹ ha^{-1}), gross return (₹ ha^{-1}), net return (₹ ha^{-1}) and B:C ratio of groundnut as affected by different treatment combinations.

Treatment	Cost of cultivation (₹ ha^{-1})	Gross return (₹ ha^{-1})	Net return (₹ ha^{-1})	B:C Ratio
I1F1M1	133838	160101	26263	1.19
I1F1M2	146725	195651	48926	1.33
I1F1M3	143834	178248	34414	1.24
I1F2M1	138784	178312	39528	1.28
I1F2M2	153245	223020	69775	1.45
I1F2M3	149653	201528	51875	1.34
I1F3M1	140880	178971	38091	1.27
I1F3M2	153510	212394	58884	1.38
I1F3M3	154345	207598	53253	1.34
I2F1M1	139531	193842	54311	1.39
I2F1M2	151321	221999	70678	1.47
I2F1M3	148085	212731	64646	1.43
I2F2M1	141720	194986	53266	1.37
I2F2M2	156071	238958	82888	1.53
I2F2M3	152648	216033	63386	1.41
I2F3M1	147472	217531	70059	1.47
I2F3M2	163185	269077	105892	1.65
I2F3M3	157281	233856	76575	1.48
I3F1M1	141389	203956	62567	1.44
I3F1M2	153820	235726	81906	1.53
I3F1M3	153730	235404	81674	1.53
I3F2M1	146523	222159	75636	1.52
I3F2M2	162502	275787	113286	1.70
I3F2M3	157638	248152	90514	1.57
I3F3M1	149321	226976	77655	1.52
I3F3M2	165452	281827	116375	1.70
I3F3M3	160573	256458	95885	1.60
General Mean	150484	219307	68822	1.45

Conclusion

On the basis of investigation it can be concluded that, to obtain higher yield parameters, yield, quality as well as economic returns, from *rabi* groundnut in Konkan region groundnut crop should be irrigated with 100% ETc through drip with 100% RDF under silver polythene mulch.

References

1. Anonymous. Fourth advance estimate, Agril. Dept. Gov. of Maharashtra; c2018-2019.
2. Arif MB, Verma IM, Khinchi V. Effect of crop geometry and drip irrigation on growth, yield and economics of groundnut (*Arachis hypogaea* L.). Environment and

ecology. 2016;34(4c):2274-2278.
3. Bhure SD. Scheduling of drip irrigation to groundnut (*Arachis hypogaea* L.) under planting layouts and transparent polythenemulch on lateritic soil of Konkan. M.Sc. Agri. Thesis submitted to Dr. B.S.K.K.V. Dapoli. M.S. (India); c2010.
4. Dabasree S, Gunri SK. Effect of polythene mulching, irrigation regimes and fertilizer doses on summer groundnut (*Arachis hypogaea* L.) nodulation, pod yield and nitrogen availability insoil. Environment and ecology. 2014;32(2):1301-1303.
5. Domber R, Channagoudar RF, Kambale AS, Janwade AD, Nekar MM. Influence of irrigation schedule and mulches on growth and quality of sunflower (*Helianthus annus* L.) in black soil of Northern Transitional Tract of Karnataka International Journal of Agricultural Science. 2010;6(1):120-123.
6. El-Habbasha SF, Okasha EM, Abdelraouf RE, Mohammed ASH. Effect of pressured irrigation systems, deficit irrigation and fertigation rates on yield, quality and water use efficiency of groundnut. International Journal of Chemical Technology Research. 2015;7(1):475-487.
7. Fageria NK, Baligar VC, Jones C. Growth and mineral nutrition of field crops 2nd Ed. Marcel Dekker, Inc, New York. 1997;1001K:494.
8. Gosavi. Effect of mulches, fertilizer and levels of organic manure on performance if rabi sweet corn (Zeya mays saccharata) M.Sc. (Agri.) Thesis Dr. BSKKV, Dapoli, Dist-Ratnagiri (M.S). Indiastat 2017-18; c2006.
9. Jain NK, Jat AR, Yadav RS, Bhaduri D, Meena HN. Polythene mulching and fertigation in peanut (*Arachis hypogaea*) Effect on crop productivity, quality, water productivity and economic profitability Indian Journal of Agriculture Science. 2018;88(8):1168-1178.
10. Jain NK, Meena HM. Improving productivity of groundnut (*Arachis hypogaea*) by using water soluble fertilizer through drip irrigation. Indian Journal of Agronomy. 2015;60(1):109-115.
11. Kamble DR, Ghokale DN, Gadade GD, Jadhav PB. Yield and economics of summer groundnut as influence by different irrigation levels and mulches International Journal Current Microbiology Applied Science. Special issue. 2018;6:135-139.
12. Khonok A, Ebrahim A, Hossein Babazadeh. The Effect of Drip Irrigation and nitrogen fertilizer on yield and Water Use Efficiency in Peanut (*Arachis hypogaea* L). International Journal of Basic Sciences & Applied Research. 2014;3(SP):78-82.
13. Mane BN, Mhaskar NV, Patil BP. Studies on sowing time, variety and mulching on growth, yield attributes and yield of groundnut under lateritic soil of South Konkan coastal zone. Journal of Soils and Crops. 2010;20(1):69-76.
14. Mathukia RK, Sagarka BK, Davaria RL. Evaluation of micro-irrigation, fertigation and weed management in summer groundnut. Innovare Journal Agriculture Science. 2014;2(2):221-227.
15. Narda NK, Thaman S, Lubana PS. Growth and yield of summer-planted bunch groundnut (*Arachis hypogaea* L.) as influenced by irrigation methods. Indian Journal of Agricultural Sciences. 2003;73(3):167-168.
16. Naresha R, Laximinarysan P, Suneetha Devi KB, Sailaja V. Quality, yield and economics of rabi groundnut as influenced by irrigation scheduling and phospogypsum levels. International Journal of Current Microbiology and Applied Sciences. 2018;7(03):3292-3303.
17. Panse VG, Sukhatme PV. Statistical method for Agricultural workers. 2nd Ed. I.C.A.R., New Delhi; c1967. p. 336.
18. Pinjari SS. Effect of integrated nutrient management and polythene mulch on the performance of sweet corn under lateritic soil of Konkan. (Ph.D. (Agri) thesis Dr. BSKKV, Dapoli Dist- Ratnagiri (M.S); c2007.
19. Ramkrishna M, Min TH, Wani SP, Long DT. Effect of mulch on soil temperature, moisture, weed infestation and yield of groundnut in northern Vietnam. Field crop research; c2006. p. 116-125.
20. Ranjitha SP, Ramulu V, Jayasree G, Reddy NS. Growth, yield and water use efficiency of groundnut under drip and surface furrow irrigation. International Journal Current Microbiology and Applied Science. 2018;7(9):1371-1376.
21. Rathore SS, Shekhawat K, Premi OP, Kandpal BK, Chauhan JS. Comparative effect of irrigation systems and nitrogen fertigation on growth, productivity and water-use efficiency of Indian mustard (*Brassica juncea*) under semi-arid conditions of Rajasthan. Indian Journal of Agronomy. 2014;59(1):112-118.
22. Sabina A. Studies on sprinkler fertigation with normal and water soluble NPK fertilizers in Geranium (*Polargonium graveolens* (L.) Heritt], M.Sc. (Agri.); c1995.
23. Shivakumar L, Radder BM, Malligawad LH, Manasa V. Effect of nitrogen and phosphorus levels and ratios on yield and nutrient uptake by groundnut in Northern transition zone of Karnataka. The Bioscan. 2014;9(4):1561-1564.
24. Soni KJ, Raja NA. Performance of groundnut (*Arachis hypogaea* L.) under drip and micro sprinkler fertigation system Vehetos an International Journal of Plant Research. 2017;30(2):2-6.
25. Sounda G, Mandal A, Moinuddin G, Mondal SK. Effect of irrigation and mulch on yield, consumptive use of water and water use efficiency of summer groundnut Journal of crop and weed. 2006;2(1):29-32.
26. Subrahmaniyan K, Kalaiselvan P, Balasubramanian TN. Microclimate variation in relation to different types of polyethylene-film mulch on growth and yield of groundnut (*Arachis hypogaea*). Indian Journal of Agronomy. 2008;53(3):184-188.
27. Sun T, Zhang Z, Ning T, Mi Q, Zhang X, Zhang S, Liu Z. Colored polyethylene film mulches on weed control, soil condition and peanut yield. Plant soil environment. 2015;61(2):79-85.
28. Thorat ST. Effect of irrigation regimes, weed management andgrowth regulators on the performance of groundnut (*Arachis hypogaea* L.) under polythene mulch. Ph.D. (Agri). Thesis submitted to Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli; c2000.
29. Verma OP, Das MKA, Sethi RR, Singandhupe RB, Rautaray SK, Mandal KG. Effect of irrigation scheduling, conjunctive use of water sources and fertilizer levels on yield and water productivity of groundnut (*Arachis hypogaea*). Indian Journal of Agronomy. 2015;60(4):576-580.

30. Vijayalakshmi R, Veerabadran V, Shanmugasundram K, Kumar V. Micro-sprinkler irrigation and fustigation and land configuration as a best management technology package for groundnut. In: 8th International Micro Irrigation Congress Innovation in Technology and Management of Micro-irrigation for Crop Production Enhancement. Tehran, Iran; c2011. p. 200-207.