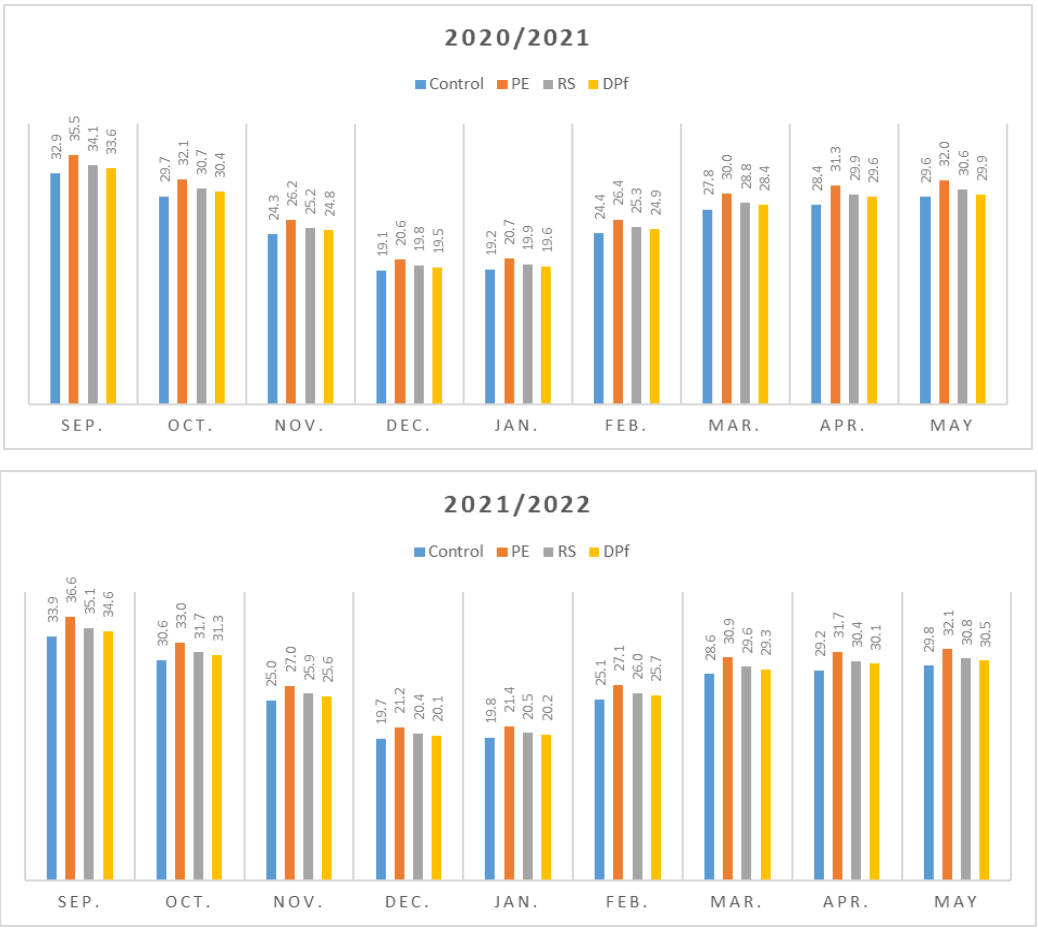
Table 3: Climatic data of the greenhouse during 2020/2021and2021/2022seasons.					
	2020/2021				
	Temperature(°C)		RH (%)	Solar Radiation	ETo
	Max.	Min.		(MJ/m^2/day)	mm
Sep.	33.6	20.3	54.6	22.2	5.45
Oct.	28.3	19.4	56.5	18.4	4.60
Nov.	24.8	17.5	61.6	13.8	3.20
Dec.	18.2	11.4	62.5	10.4	2.10
Jan.	19.6	11.8	61.5	10.8	2.30
Feb.	23.2	13.6	58.4	11.3	3.20
Mar.	27.4	14.4	56.3	12.6	4.20
Apr.	28.3	15.6	57.2	15.6	4.70
May	29.5	16.8	58.6	18.7	4.90
2021/2022					
Sep.	32.9	19.9	53.5	21.8	5.38
Oct.	29.7	20.4	59.3	19.4	4.70
Nov.	24.3	17.2	60.3	13.5	3.15
Dec	19.1	12.0	65.7	10.9	2.20
Jan	19.2	11.6	60.3	10.2	2.10
Feb	24.4	14.3	61.3	11.6	3.30
Mar	27.8	14.8	57.8	12.9	4.30
Apr.	28.7	16.1	58.4	15.8	4.80
May	29.9	17.3	59.8	18.9	5.21

3.5 Economic study

The economic evaluation was estimated by calculating the cost of cultivation for different agro-inputs, i.e., labour, irrigation, fertilisers, harvesting, and other necessary experimental requirements. Pumping water costs were divided into two main categories: (i) fixed costs and (ii) operating costs, which vary with the number of operating hours. The average cost of pumping one cubic metre of water was estimated at 0.12 L.E. (Egyptian pound) according to (Abdrabbo et al., 2021). The returns of each tested treatment were calculated according to (Cimmyt, 1988).

4. Results and Discussion

Soil temperature



Polyethylene mulch (PE), Rice straw (RS), Date palm fiber wastes (DPf)

Figure 1: The soil temperature under different cover materials compared to the uncovered soil (control) of 2020/2021and 2021/2022.

The average soil temperatures for the different cover materials showed that the use of transparent plastic covers influenced soil temperatures. The temperature tended to be higher under the polyethylene mulch by almost 2 °C than under the control treatment during the two seasons. Applying rice straw and date palm waste mulches had a higher soil temperature than control by about 1.0°C during the two seasons. According to the soil temperature under the different mulches is affected by the type of material employed, and the temperatures registered in bare soil are always lower than under mulch treatments (Moreno et al., 2009). A These results are in line with the findings (Arora et al., 2011; Pramaniket al., 2015). They reported that plastic mulch affects the thermal regime of soil by altering soil temperature. Moreover, Mousy et al. (2of the5) confirmed the increment of soil temperature duestraw, he greater solar radiation transmittance of transparent plastic cover compred with the rice straw which highly reflects or absorbs solar radiation. Furthermore, result monstrated that soil temperatures under rice straw mulch were higher during the cold season when compared with the bare soil (Figure. 1). In contrast, during the cold conditions, rice straw mulch insulates the soil from the colder air temperatures and lowers the heat loss from the soil (Yi et al., 2009). However, warmer soil temperatures can quicken seedling emergence and growth to achieve the desired population structure at an earlier growth stage which maximises the absorption of solar radiation and enhance the yield (Li et al., 2013).

Tables 4 and 5 show that there were significant differences between treatments in terms of vegetative growth parameters, i.e., plant height, number of branches, plant stem diameter, SPAD, and fresh and dry weight of plants of hot pepper plants under different soil cover and water levels. The results presented in Table 4 indicated that the highest vegetative growth characteristics were preceded by 100% WR and followed by 75% WR in the two seasons. The lowest vegetative growth was obtained at 50% WR. Regarding the soil cover treatments, the obtained results indicated that transparent polyethylene cover resulted in the highest vegetative growth parameters compared to the other soil cover treatments. The organic soil cover treatments (rice straw and date palm fibre wastes) came in the second order. The lowest vegetative growth was obtained by bare soil (unmulched treatments).

According to the interaction effect, 100% water level combined with transparent plastic cover obtained the highest significant values, while the lowest values of interaction were found in deficit irrigation treatment (50% WR) combined with control treatment (without soil cover) during both studied seasons.

The better vegetative growth of hot pepper under 100% WR during the two seasons may have been due to high soil moisture leading to the dissolving of the nutrient elements in the root zone area, which led to enhanced nutrient uptake (Abdrabbo et al., 2010). Another possibility is high soil moisture under 100% WR, which enhances a deeper and more extensive root system. The deeper and stronger root system can improve the biological process and then enhance the dry matter accumulation, leading to higher fresh and dry weights (El-Dolify et al., 2016). On the other hand, the obtained results indicated that using plastic or organic mulch enhanced vegetative growth significantly compared to bare soil. The obtained results may be because soil mulch led to maintaining soil temperature and soil moisture and provided good air circulation within soil spores. Furthermore, revealed that mulching has contributed positively to improving growth and productivity (Filipović et al., 2016; Abdrabbo et al., 2010). Although clear plastic mulch may increase soil temperature, the presence of light leads to weed growth. While the absence of light with other mulch types did not allow the photosynthesis of weeds, weed growth was suppressed (Farrag et al., 2016).

Table 4: Effect of water level and soil cover on hot pepper vegetative growth in 2020/2021 and 2021/2022 seasons

	Plant height (cm)				Branch no.				Stem diameter(mm)				Chlorophyll(SPAD)			
2020/2021																
	50%W	75%W	100%W	Mean	50%W	75%W	100%W	Mean	50%W	75%W	100%W	Mean	50%W	75%W	100%W	Mean
control	131.3k	142.2g	160.2c	144.6C	32.3l	48.4h	53.2 e	44.6D	0.51j	0.61g	0.71d	0.6B	117.4l	131.2h	145.7d	131.4D
DPf	122.3l	140.3h	152.3e	138.3D	36.2k	49.4g	55.3d	47.0C	0.55i	0.63f	0.72c	0.6B	122.7k	135.7g	151.3c	136.6C
RS	137.4i	158.2d	169.3b	153.9B	46.3i	57.2b	56.4c	54.5A	0.61g	0.67e	0.76b	0.7A	123.4j	141.9f	158.7b	141.3B
PE	135.2jk	147.1f	179.4a	155.0A	40.2j	51.3f	60.1a	49.3B	0.58h	0.67e	0.80a	0.7A	130.1i	144.2e	163.4a	145.9A
Mean	131.6C	147.0B	165.3A		38.8C	51.6B	56.2A		0.6B	0.6B	0.7A		123.4C	138.3B	154.8A	
2021/2022																
control	135.4i	143.3g	162.5c	147.1B	33.4j	50.6f	55.3cd	46.5D	0.58j	0.83f	1.0b	0.8C	120.7l	132.8h	147.5d	133.7D
DPf	125.5j	145.5f	153.6d	141.6C	37.6i	51.5f	56.5c	48.4C	0.67i	0.87e	1.0b	0.8C	124.6k	137.5g	153.3c	138.4C
RS	138.4h	161.4c	169.3b	156.4A	47.2g	59.6b	62.9a	56.7A	0.76h	0.90d	1.1b	0.9B	125.6j	143.8f	160.4b	143.2B
PE	140.0h	150.5e	179.8a	156.8A	41.6h	53.1e	57.6c	50.8B	0.80g	096c	1.3a	1.0A	131.5i	145.5e	165.5a	147.5A
Mean	134.9C	150.2B	166.3A		40.0C	53.7B	58.1A		0.6C	0.9B	1.1A		125.6C	139.9B	156.7A	

Polyethylene mulch (PE), Rice straw (RS), Date palm fiber wastes (DPf)

Table 5: Effect of water level and soil cover on hot pepper dry weight and SPAD in 2021-2022and 2022-2023 seasons

	Plantfresh weight (g/ plant-1)				Plant dry weight(g /plant-1)			
2020/2021								
	50%W	75%W	100%W	Mean	50%W	75%W	100%W	Mean
control	260.3l	311.2h	340.3d	303.9D	75.2k	90.4g	102.6d	89.4D
DPf	278.4k	318.3g	358.9c	318.5C	80.7j	95.4f	105.8c	94.0C
RS	296.7i	327.3f	362.2b	328.7B	85.3i	97.3f	112.4b	98.3B
PE	287.5j	330.9e	377.0a	331.8A	87.9h	100.5e	120.2a	102.9A
Mean	280.7C	321.9B	359.6A		82.3C	95.9B	110.2A	
2021/2022								
control	262.0l	313.8h	342.2d	306.0D	78.8l	94.8h	104.9d	92.9D
DPf	279.5k	320.4g	361.4c	320.5C	89.5k	98.6g	106.5c	98.2C
RS	298.4i	329.4f	364.8b	330.9B	91.6j	101.6f	115.4b	102.9B
PE	289.6j	332.7e	378.9a	333.7A	93.7i	103.5e	121.6a	106.3A
Mean	282.4C	324.1B	361.8A		88.4C	99.6B	112.1A	

Polyethylene mulch (PE), Rice straw (RS), Date palm fiber wastes (DPf)

The data in Table (6) present the effect of water level and soil cover material on nitrogen, phosphorus, and potassium percentages in hot pepper leaves in the 2020–2021 and 2021–2022 seasons. Nitrogen, phosphorus, and potassium percentages in leaves showed significant differences between the treatments; the highest value was found at a water level of 100%, while the least value was found at a 50% water level. The polythene cover treatment gave the highest significant values of nitrogen, phosphorus, and potassium percentages compared to the other soil cover treatments. Using rice straw or date palm fiber waste had higher NPK percentages than bare soil treatments.

The best interaction between water level and soil cover material was found at 100% water level. This may be due to the increasing uptake of NPK or may be due to the nutrient movements towards fruits or other plant organs, which means higher productivity led to a decrease in the percentage of nutrients in hot pepper plant leaves. The same results were obtained who stated that 100% WR provided the proper soil moisture for hot pepper plants, which enhanced nutrient uptake and then metabolite translocation (Ariana et al., 2017; Abdrabbo et al., 2010). Regarding the effect of PE mulch treatments on NPK percentages, the obtained data revealed that PE recorded the highest values of NPK percentages in the two studied seasons. These results were in agreement with those obtained who mentioned that using plastic cover mulch increases plant root zone temperature, which has an important role in water and nutrient uptake as well as root system activities (Farrag et al., 2016; Abdrabbo et al.,2009; EI-Dolify et al., 2016; Farrag et al., 2016).

Table 6: Effect of water level and soil cover on hot pepper nitrogen, phosphor and potassium percentage in leaves in 2020-2021and 2021-2022 seasons.

	N%				P%				K%			
2020/2021												
	50%W	75%W	100%W	Mean	50%W	75%W	100%W	Mean	50%W	75%W	100%W	Mean
control	2.5g	2.89d	3.11c	2.86D	0.20f	0.26e	0.37c	0.28C	2.72j	3.18f	3.37d	3.09D
DPf	2.6f	2.92d	3.40b	2.99C	0.25e	0.32d	0.41b	0.33B	2.82i	3.19f	3.45c	3.15C
RS	2.7e	2.96d	3.46b	3.06B	0.23e	0.32d	0.43b	0.33B	2.88h	3.21ef	3.52b	3.20B
PE	2.83d	3.10c	3.63a	3.18A	0.26e	0.33d	0.49a	0.36A	3.06g	3.24e	3.61a	3.30A
Mean	2.70C	2.97B	3.40A		0.23C	0.31B	0.43A		2.87C	3.20B	3.49A	
2021/2022												
control	2.56j	3.02g	3.60d	3.06D	0.21k	0.28g	0.38d	0.29D	2.79g	3.87e	4.63b	3.76D
DPf	2.66i	3.28f	3.69c	3.21C	0.22j	0.33f	0.43c	0.33C	2.87g	4.11d	4.72b	3.90C
RS	2.74i	3.42e	3.75b	3.30B	0.25i	0.34e	0.45b	0.35B	2.98g	4.31c	4.81a	4.03B
PE	2.88h	3.51e	3.97a	3.45A	0.27h	0.34e	0.49a	0.37A	3.46f	4.45c	4.92a	4.27A
Mean	2.71C	3.31B	3.75A		0.24C	0.32B	0.44A		3.02C	4.19B	4.77A	

Polyethylene mulch (PE), Rice straw (RS), Date palm fiber wastes (DPf)

Table (7) 7 shows the total yield (kg/m2) and vitamin C content of hot pepper fruits. The total yield increased with the increasing water level. Using 100% WR increased the sweet pepper yield compared to the other water level treatments during the two growing seasons. The 75% water level came in second place. The higher yield production under 100% water levels may be due to increasing available water and nutrient uptake, which ultimately accelerated the rate of vegetative growth and yield (Zakher and Abdrabbo et al., 2014; EI-Dolify et al., 2016). Further, the polythene mulch offers a better total yield than the other soil cover treatments. Transparent plastic covers recorded the highest values of yield per plant in the two studied seasons. These results were in agreement with those obtained by who found that using polyethylene mulch increases plant root zone temperature, which has an important role in plant growth and productivity (Farrag et al., 2016). Transparent plastic mulches increase vegetable crop growth and productivity compared to other mulch material treatments (Farrag et al., 2016).

Regarding the interaction effect between water level and soil cover treatment, the highest vitamin C content in hot pepper fruits was obtained by 100% water level combined with transparent PE cover. These results are in line with, who stated that mulching film had a positive effect on pepper yield and ascorbic acid content (Magdaléna et al., 2022). Sustained moisture supply by using proper water quantities in a mulched situation enhanced plant yield.

Table 7: Effect of water level and soil cover on hot pepper total yield (kg/m2) and fruits vitamin C content in 2020-2021and 2021-2022 seasons.

	yield (kg/m2)				V.C			
2020/2021								
	50%W	75%W	100%w	Mean	50%W	75%W	100%W	Mean
control	3.6l	8.5h	10.0d	7.4D	62.4l	84.6h	107.2d	84.8D
DPf	4.1k	8.9g	11.3c	7.5C	69.7k	88.1g	112.3c	90.0C
RS	4.8j	9.1f	11.8b	8.1B	73.7j	91.7f	126.5b	97.3B
PE	5.2i	9.5e	12.6a	8.8A	81.1i	92.3e	139.4a	104.3A
Mean	3.6C	9.0B	11.4A		71.7C	89.2B	121.4A	
2021/2022								
control	3.5l	7.7h	10.8d	6.7D	63.3k	85.8g	108.8d	85.9D
DPf	4.1k	8.0g	11.9c	7.6C	70.3j	89.3f	113.7c	91.2C
RS	4.7j	8.6f	12.6b	8.2B	73.6i	92.5e	127.9b	98.0B
PE	5.2i	9.2e	13.6a	8.9A	82.4h	94.6e	131.1a	102.7A
Mean	4.4C	8.4B	12.2A		72.4C	90.5B	120.4A	

Polyethylene mulch (PE), Rice straw (RS), Date palm fiber wastes (DPf)

Table 8: Effect of different water levels and soil cover material on water use efficiency (WUE) during 2020-2021and 2021-2022seasons.

	2020/2021				2021/2022			
	50%W	75%W	100%w	Mean	50%W	75%W	100%W	Mean
control	13.5h	20.8ed	19.0f	17.8D	14.5h	22.5c	19.5e	18.8D
DPf	15.5g	22.5c	21.5d	19.8C	15.8g	23.7b	23.4b	21.0C
RS	18.4f	23.2c	22.4c	21.4B	18.8f	24.3b	22.3c	21.8B
PE	20.0e	25.3a	24.2b	23.2A	20.5d	25.6a	24.4b	23.5A
Mean	16.8C	23.0A	21.8B		17.4C	24.0A	22.4B	

Polyethylene mulch (PE), Rice straw (RS), Date palm fiber wastes (DPf)

With decreasing water levels, the water use efficiency (WUE) of hot peppers dropped gradually. Table(8). The greatest value of water use efficiency of hot pepper plants was obtained with a 75% water level, with no significant differences between 75% and 100%, while the lowest value was obtained with a 50% water level. Excessive irrigation, e.g., with 120% full evapotranspiration, has been reported to lower the WUE due to deep percolation and leaching (Dalla and Giovanardi, 2000). Soil cover significantly led to an increase in the WUE for hot pepper plants under all treatments of applying water levels (Table 8). Results indicated a significant increase in the WUE using PE, followed by RS and DPF mulch. The lowest WUE was obtained by the control treatment. Soil cover leads to evaporation from the soil surface particularly in the periods before vegetation has covered the ground fully (Kumari, 2012; (Kumari, 2012). Furthermore, mulching with crop residues improved water use efficiency by 10–20% by reducing soil evaporation and increasing plant transpiration (Deng et al., 2006). indicated that the increase in WUE could be due to the increment in crop yield. On the contrary, excessive water volume can decrease the plant's growth rate due to oxygen deprivation in the roots. Besides, the additional water should reflect a similar rate of increment in yield due to additional costs, based on WUE. However, the type of soil should also be considered. Polyethylene mulch led to increased water use efficiency for plants because it reduced the growth of weeds during the growing season (Darwesh et al., 2019).

Table 9: Average Economic evaluation for using water level treatments and soil cover of hot pepper during the two studied seasons.

		yield KG/GH	water pumping cost	Price LE/ Kg	Gross income per LE/ GH/ season	Soil cover cost LE/ GH/ season	Manual weeding cost/ LE/ GH	Other cost LE/ GH	Net cost LE/ GH/ season
50%W	control	1437.98	18.70	5	7190	0	420	4500	2251
	DPf	1623.92			8120	560	0	4500	3060
	RS	1929.92			9650	525	80	4500	4545
	PE	2068.85			10344	490	80	4500	5274
75%W	control	2649.16	28.06		13246	0	420	4500	8298
	DPf	2733.43			13667	560	0	4500	8607
	RS	2853.52			14268	525	80	4500	9163
	PE	2957.96			14790	490	80	4500	9720
100%W	control	3892.83	37.41		19464	0	420	4500	14507
	DPf	3659.28			18296	560	0	4500	13236
	RS	3968.19			19841	525	80	4500	14736
	PE	4467.38			22337	490	80	4500	17267

Polyethylene mulch (PE), Rice straw (RS), Date palm fiber wastes (DPf)

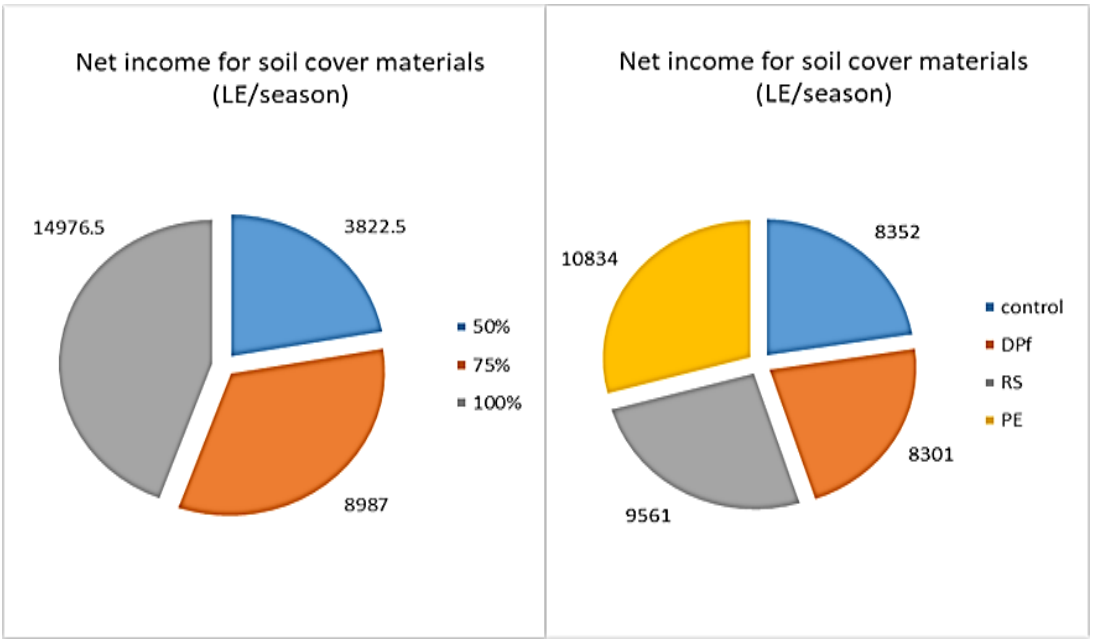


Figure 2: The net income under water level and different cover materials compared to the uncovered soil (control).

Economic evaluation: The operating costs of producing one greenhouse of hot peppers using three water levels and different soil cover treatments were calculated, including the seasonal operation costs such as pumping irrigation water and soil cover (Table 9). The other costs included seedlings, fertilization, pest control, etc. The price of the pepper yield was collected from the average wholesale price during the study period. The results in Figure 2 show that using 100% of WR gave the highest net income values, followed by using 75% WR. Obtained data indicated that the net income of using transparent plastic soil cover was higher than that of using other soil cover materials, followed by soil cover with rice straw (Figure 2). The cover material led to decreased weeding costs compared to control. From the results, we can conclude that the use of cover material enhances the profitability of hot peppers during the two seasons. These results were in agreement with who reported that the choice of an appropriate mulching material depends on local climate, cost-effectiveness, and crop feasibility (Wang et al., 2015).

5. Conclusion

This paper was obtained to evaluate the influence of water level and different types of soil cover on the growth and productivity of hot pepper plants. Using a transparent polyethylene cover with a 100% water level enhances the hot pepper's vegetative growth parameters, chemical contents, and total yield. On the other hand, 75% water level is more effective for water use efficiency. Economically, the choice of an appropriate mulching material depends on local climate and cost-effectiveness.

References

Abdrabbo, M. A. A., Farag, A. A., M. Hassanein, K. and Abou-Hadid, A. F., 2010. Water consumption of eggplant under different microclimate. J. Biol. Chem. Environ. Sci., 5(3), Pp. 239- 255.

Abdrabbo, M. A. A., Maharik, Z. Y., Mohammed, M. H., and Farag, A.A., 2021. Evaluation of mulch types and Irrigation Levels on productivity and water use efficiency of onion. Egypt Journal of Appl. Sci., 36. Pp. 11-12.

Abdrabbo, M.A.A. ,Farag, A.A., and Hassanein, M.K., 2009. Irrigation requirements for cucumber under different mulch colors. Egypt. J. Hort., 36: Pp. 333- 346.

Abdrabbo, M.A.A., Saleh, S.M., and Hashem F.A., 2017. Eggplant production under deficit irrigation and polyethylene mulch. Egypt. J. Appl. Sci., 32(7).

Abou-Hadid, A.F., and El-Beltagy A. S.,1992. Water balance under plastic house conditions in Egypt. Acta Horticulture 303: Pp. 61-72

Ahmad, P., 2016. Water stress and crop plants: A sustainable approach. John Wiley and Sons, Ltd., India, 756 p. DOI: 10.1002/9781119054450

Almeida,W.F.D., Lima, L.A., and Pereira, G.M., 2015. Drip pulses and soil mulching effect on American crisp head lettuce yield. EngenhariaAgrícola, 35, Pp. 1009-1018

Amiri, E., Gohari,A.A., and Esmailian, Y., 2012. Effect of irrigation and nitrogen on yield, yield components and water use efficiency of eggplant. African J. Biotech., 11(13): Pp. 3070-3079.

Arora, V.K., Singh, C.B., Sidhu, A.S., and Thind S.S., 2011. Irrigation, tillage and mulching effects on soybean yield and water productivity in relation to soil texture. Agricultural Water Management, 98 (4), Pp. 563-568.

Azad, B., M.R. Hassandokht and K. Parvizi., 2015. Effect of Mulch on Some Characteristics of Potato in Asadabad, Hamedan. International Journal of Agronomy and Agricultural Research, 6 (3): Pp. 139-147

Badr, M.A., El-Tohamy, W.A., Abou-Hussein, S.D., and .Gruda, N.S.,2020. Deficit irrigation and arbuscular mycorrhiza as a water-saving strategy for eggplant production. Horticulturae, 6(45). DOI: 10.3390/horticulturae6030045

Chakraborty,D. S., Nagarajan, P., Aggarwal, V.K., Gupta, R.K,. Tomar, R.N. Garg, N., 2008. Effect of mulching on soil and plant water status, and the growth and yield of wheat (Triticumaestivum L.) in a semi-arid environment. Agricultural Water Management, 95 Pp. 1323-1334

Cimmyt., 1988. From agronomic data to farmer recommendation: An economic workbook. DF: Pp. 31-33.

Dalla, C. L. ,andGiovanardi,R., 2000. Nitrogen Use Efficiency in Tomato and Potato as Affected by Water Regime and N Fertilization, p. 443–447. In: G. Parente and J. Frame (eds.). Proc. COST 814 Final Conf., Pp. 10–13 May 2000, Pordenone, Italy

Darwesh, R. K.h., Farrag D. K.h., and Moursi, E.A., 2019. Effect of irrigation scheduling and intercropping pattern on growth, yield, quality of green onion, lettuce and some water relations in north nile delta region. J. Soil Sci. and Agric. Eng., Mansoura Univ., 10 (12):Pp. 841-850.

Deng, X., Shan, L., Zhang, H.,and Turner, N. C., 2006. Improving Agricultural water Use Efficiency in Arid and Semiarid Areas of China. Agricultural Water Management, 80: Pp. 23–40.

Dvorak, P, J. Tomasek, P. Kuchtova, K. Hamouz, J. Hajslova and V. Schulzova., 2012. Effect of Mulching Materials on Potato Production in Different Soil Climatic Conditions. Romanian Agricultural Research, 29: Pp. 201-209.

EI-Dolify, M.M., Abdrabbo,M.A. Abou EI-yazied ,A. and E. ldeeb, M.,2016. Effect of using soil conditioners on tomato yield and water use efficiency. J. Agrie. Sei., 24(1), Pp. 195-204.

Eman, A.G., Mohamed , S.A. A., Mahmoud ,M.I., and El-Kassas, A.I., 2018. Hybrids variation and wheat straw mulch effects on vegetative growth and fruit yield of sweet pepper under EL-ARISH area conditions. SINAI Journal of Applied Sciences (ISSN: 2314-6079), Vol. (7), Is. (3), Dec.Pp187-196

FAO (Food and Agriculture Organization), 1980. Soil and plant analysis. Soils Bulletin 38/2, 250.

FAO, 1982. Crop water requirements irrigation and drainage. Paper 24, Rome, Italy. https://www.fao.org/publications.

Farag, A. A., Abdrabbo, M. A. A., and Hassanein, M. K., 2010. Response of cucumber for mulch colors and phosphorus levels under greenhouse. Egypt J. Hort. 37, 1: Pp.53-64.

Farrag ,K., . Abdrabbo, M. A. A., and Sabry, A. M. H., 2016. Growth and productivity of potato under different irrigation levels and mulch types in the North West of the Nile Delta, Egypt. Middle East Journal of Applied Sciences, 6: Pp. 774- 786.

Filipović, V., Romić, D., Romić, M., Borošić, J., Filipović, L., Mallmann, F.J.K., Robinson, D.A., 2016.Plastic mulch and nitrogen fertigation in growing vegetables modify soil temperature, water and nitrate dynamics: Experimental results and a modeling study.Agricultural Water Management, 176, Pp. 100-110

Ji, S., Unger ,P.W., 2001. Soil water accumulation under different precipitation, potential evaporation and straw mulch conditions. Soil Science Society of America Journal, 65 Pp. 442-448

Kader, M.A., Senge, M., Mojid,M.A., Ito, K., 2017. Recent advances in mulching materials and methods for modifying soil environment .Soil and Tillage Research, 168, 2017, Pp. 155-166

Kar G. and A. Kumar, 2007. Effects of Irrigation and Straw Mulch on Water Use and Tuber Yield of Potato in Eastern India. Agricultural Water Management, 94: Pp. 109- 116.

Kumar, S., Sharma, I.P., and Raina, J.N., 2005. Effect of Levels and Application Methods of Irrigation and Mulch Materials on Strawberry Production in North-West Himalayas. J. Indian Soc. Soil Sci., 53: Pp. 60-65.

Lamont, W.J., M.D. Orzolek, L. Otjen and T. Simpson, 2000. Production of Potatoes Using Plasticulture. Proceeding of 15th International Congress for Plastics LASTICS in Agriculture and the 29th National Agricultural Plastics Congress. 29: Pp. 599-601.

Li, Y., Cheng, R., Spokas, K. A, Palmer, A. A., and Borevitz, J. O., 2014. Genetic variation for life history sensitivity to seasonal warming in Arabidopsis thaliana. Genetics, 196, Pp. 569- 577. https://doi.org/10.1534/genetics.113.157628

Magdaléna,V. F.,Ji,r. c., Martina, B. c., Anna A., Martin, A., and Tunde, J., 2022. Influence of Varieties and Mulching on the Quality and Quantity of Vegetable Pepper Yield. Horticulturae, 8, 1035. https://doi.org/10.3390/horticulturae8111035.

Mehan, S., and Singh K.G., 2015. Use of mulches in soil moisture conservation: A reviewBest Management Practices for Drip Irrigated Crops, 2, 24, Pp. 283

Molla,T., Girma,A.J., Sheleme,B., 2019. Effects of Nitrogen Fertilizer and Mulch Application on Growth Performance and Pod Yields of Hot Pepper (Capsicum annuum L.) under Irrigated Condition.International Journal of Plant and Soil ScienceDOI:10.9734/ijpss/2019/v27i530089

Moreno, M., Moreno, A., and Mancebo, I., 2009. Comparison of Different Mulch Materials in Tomato (Solanilycopersicume) Crop. Spanish Journal of Agricultural. Research, 7(2):Pp. 454-464.

Moursy, S.F., Mostafa, A.F., and Solieman, Y.N., 2015. Polyethylene and Rice Straw as Soil Mulching: Reflection of Soil Mulch Type on Soil Temperature, Soil Borne Diseases, Plant Growth and Yield of Tomato. Global Journal of Advance Research, 2 (10): 1497-1519.

Pramanik,P., Bandyopadhyay, K.K., Bhaduri, D.,Bhattacharyya, R., Aggar wal. P.,2015. Effect of mulch on soil thermal regimes - a review.International Journal of Agriculture, Environment and Biotechnology, 8 ,3, Pp. 645

Qin, W., Wang, D., Guo, X., Yang, T., Oenema O., 2015.Productivity and sustainability of rain-fed wheat–soybean system in the North China Plain: Results from a long-term experiment and crop modeling. Scientific Reports, 5, Pp. 17514.

Ramakrishna, A., Tam, H.M., Wani, S.P., Long, T.D., 2006. Effect of mulch on soil temperature, moisture, weed infestation and yield of groundnut in northern Vietnam. Field Crops Research, 95. 2–3, Pp. 115-125.

Ruíz-Machuca, L.M., L. Ibarra-Jiménez, L.A. Valdez-Aguilar, V. Robledo-Torres, A. Benavides-Mendoza and M. Cabrera-De La Fuente, 2014. Cultivation of Potato – Use of Plastic Mulch and Row Covers on Soil Temperature, Growth, Nutrient Status, and Yield. ActaAgriculturaeScandinavica, Section B-Soil and Plant Science, 65 (1): Pp.30-35.

Siczek, A., and Lipiec J., 2011. Soybean nodulation and nitrogen fixation in response to soil compaction and surface straw mulching. Soil and Tillage Research, 114. 1. Pp. 50-56.

Tahir M., Rashid M. R., Sunny A., Saima S., Asma G., Muhammad A. K., Fahad M. Wattoo,Xiukang Wang,Ferdinando. Branca, Freddy Mora-Poblete, Gabrielle Sousa M., and Xionming D., 2021. Effect of drought stress on capsaicin and antioxidant contents in pepper genotypes at reproductive stage. Plants 2021, 10(7), 1286; https://doi.org/10.3390/plants10071286

Wang, H.J., Gao, J.E., Li, X.H., and Zhang, S.L., 2015. Nitrate accumulation and leaching in surface and ground water based on simulated rainfall experiments. PLoS ONE, 10: e0136274.

Watanabe, F.S., and Olsen, S.R., 1965. Test of an ascorbic acid method for determining phosphorus in water and NaHCO3 extracts from soil. Soil Sci. Soc. Amer. Proc., 29: Pp. 677-678.

Yi, L., J. Wang, D. Liu, Z. Li and G. Zhang, 2014. Straw Mulching Reduces the Harmful Effects of Extreme Hydrological and Temperature Conditions in Citrus Orchards. PLOS ONE 9(1): e87094.

Yin, W., Feng, F., Zhao, C., Yu, A., Hu, F., Chai, Q., Guo, Y., 2016. Integrated double mulching practices optimizes soil temperature and improves soil water utilization in arid environments. International Journal of Biometeorology, 10.1007/s00484-016-1134-y

Zakher, A.G., and Abdrabbo, M. A. A., 2014. Reduce the harmful effect of high temperature to improve the productivity of tomato under conditions of newly reclaimed land. Egypt. J. Hort. Vol. 41, No.2, Pp.85 -97

Zhou, L.M., Li, F.M., Jin S.L., and Song, Y.J., 2009. How two ridges and the Furrow mulched with plastic film affect soil water, soil temperature and yield of maize on the semiarid loess plateau of China. Field Crops Research, 113: 18. Pp. 41–47.

Zribi, W., Aragüés, R., Medina, E., Faci J.M., 2015. Efficiency of inorganic and organic mulching materials for soil evaporation control. Soil and Tillage Research, 148. Pp. 40-45