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Sustainable Water Management using Soil Mulching and Drip Irrigation Strategies for Faba Bean Production

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THE ISSUE of water stress has over the last ten years become one of the major international issues with a substantial challenge on food security in dry and semi dry lands especially in the Middle East. This study determined the potential of reducing water scarcity through soil mulching and drip irrigation system. This research was aimed at comparing various mulching methods and experimented effect due to irrigation levels with drip irrigation system. A factorial combination of 3 levels of water (i.e. 100%, 80 and 60 % ETc) and 3 levels of mulch treatments (no Mulch (NM), Straw Mulch (SM) and Plastic Mulch (PM)) with 3 replications. The results strongly indicate that the irrigation regime and the level of mulch have great impact on the seed yield, straw yield and the water use efficiency (WUE) of faba bean. Moderate irrigation (IR2) and Straw mulch (SM) combination returned the best values on the seed yield (2.875 ton/fed.), straw yield (5.318 ton/fed) and WUE (2.771 kg/m 3). It brings out the need to have a good soil moisture level in relation to water conservation which is well implemented through organic mulching. These benefits are accredited to better water retention, soil cooling and increase in physiological response under water stress.

Keywords: Faba bean, deficit irrigation, mulching, drip irrigation, Sustainable water management.

Introduction

Increasing scarcity of water has become one of the most serious limitations to economic growth in arid and semi-arid areas including Egypt, of whose agricultural sector stands as the biggest user of freshwater resources. Due to rising water stress, a number of countries have ended up using non-renewable fossil groundwater to fulfill short term water need. Such a strategy however presents l poling term threats to the performance of the water supply, food security and consequent economic competence.

Due to the scarcity of opportunities to increase water supply and the growing pressure on the existing resources, an increase in water productivity is becoming a strategic necessity. In farming we can say that this objective is reflected in the strategy of achieving more crop and high value per drop (FAO, 2023). This is leading to the new trend where irrigation is managed to maximize crop yield rather than on the amount of water required per hectare of land. Such shift involves optimal water management practices as the use of the best irrigation methods, optimal timing and use of water-saving irrigation technology like alternate furrow irrigation, surge flow, and regulated deficit irrigation (Abdeen et al., 2024; Ahmed et al., 2025). Deficit irrigation is a water-saving strategy that supports sustainable crop production in water-scarce regions. By deliberately reducing water supply during specific growth stages or throughout the growing season, this approach can enhance both yield and fruit quality in citrus trees (Ennab et al., 2020). The effectiveness of deficit irrigation largely depends on water regimes the levels and timing of irrigation which play a crucial role in determining crop growth and productivity. Optimizing irrigation schedules can significantly increase water use efficiency (WUE) without compromising yield, particularly in legumes, which exhibit moderate tolerance to water stress (Bayisa et al., 2024 and Abdelaal 2023). Furthermore, strategic application of moderate deficit irrigation has been shown to improve physiological traits, promote root development, and enhance sink-source balance in various crops (Wang et al., 2024).

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Experience has shown that mulching is an efficient agronomic practice that can be used to enhance the quality of soil and boost the production of crops especially in water stressed environments. It can significantly improve the physical, chemical and biological properties of soil due to (i) increased organic matter content, (ii) enhanced soil structure, and (iii) enhanced microbial activity. These modifications facilitate the growth of roots and enhance the availability and uptake of nutrients, hence, leads to enhanced growth and productivity of plants (Hailu and Bogale, 2024 and Abd-Elhakim et al.,2021).

Mulching is important when it is incorporated with deficit or drip irrigation systems in that it helps to save soil moisture especially when crops are in their critical stage of growth. It is known that this synergistic method minimizes evaporation losses, increases water retention and can significantly reduce the irrigation needs without having any adverse effect on the yield. Indeed, a small number of studies state that using mulching combined with modern irrigation methods leads to higher water use efficiency (WUE) (Kibria et al., 2024; Bekele and Mengasha, 2023).

A recent meta-analysis demonstrates that under deficit irrigation, unproductive water losses of up to 70% may be alleviated by the practice of organic or plastic mulch, therefore improving irrigation water use efficiency and crop tolerance under drought methane conditions (Rossi et al., 2024 and Mansour et al 2014). Such results favor the implementation of mulching as a sustainable option in arid and semi-arid farming as well as cost effective.

Faba bean (Vicia faba L.) stands as a vital winter legume cultivated across Mediterranean and subtropical regions due to its high protein content and ability to enhance soil fertility through biological nitrogen fixation. However, the species demonstrates pronounced sensitivity to both drought stress and water logging conditions. Prior research indicates that water deficits during pivotal phenological stages such as flowering and pod-filling can substantially diminish seed yield (Abdelhaleim et al., 2022 and Abdellateef 2025) To address this challenge, integrating precision irrigation technologies such as drip or leaky-pipe systems with regulated water scheduling and soil mulching has gained prominence. Field studies in Egyptian semi-arid agroecosystems confirm that such integrated practices optimize soil moisture, bolster root growth, and substantially increase water use efficiency (WUE). For example, leaky-pipe irrigation at 70% of crop evapotranspiration combined with humic acid or compost can improve WUE to approximately 1.9 kg m^{-3}, while conserving up to 30 % of irrigation water compared to conventional methods (Ali,2023). Similarly, (Imam et al. 2025) reported optimum yield and WUE under drip irrigation at 100% ET_o with compost application, suggesting no additional benefit from higher irrigation volumes in sandy soils.

This study aims to evaluate the combined effects of various irrigation regimes and mulching materials on the growth performance, yield components, and water use efficiency (WUE) of faba bean (Vicia faba L.) under drip irrigation. The outcomes are expected to contribute to improved understanding of sustainable crop management strategies in semi-arid environments, where optimizing water resources is essential for enhancing legume productivity..

Materials and Methods

The field experiments were carried out during two consecutive growing seasons at Agricultural Research Station of the National Research Centre in El-Nubaria District, Egypt (30.286 o N, 30.1033 o E; 68 m a.s.L.). The location is of the semi-arid Mediterranean climate. The experiment plots were sampled before the planting was done on a composite soil sample (0-30cm depth). Through the standard methods, these samples were examined as follows: Particle-size distribution using hydrometer technique, bulk density and porosity through core analysis and the chemical characteristics of pH, electrical conductivity, and organic carbon following ASTM procedures of (Gee and Bauder, 1986 and Sparks et al. 2020). Table 1 gives the summarization of the results .

Included in irrigation water was a monthly sampling and analysis of its physical and chemical characteristics of pH, EC, sodium adsorption ratio, and ion concentrates as used in (APHA ,2017). Table 2 reports the data.

Table 1. Physical and mechanical properties of soil at the experimental site.

Depth, cm	Physical properties						Mechanical characteristics, %			
	SP,	θ_{Fc}	θ_{wp}	A.W, %	BD,	HC,	Course sand	Fine sand	Clay + Silt	Texture
0 – 20	21	10.1	4.7	5.4	1.69	7.5	47.76	49.75	2.49	Sandy
20 – 40	19	13.5	5.6	7.9	1.69	4.2	56.72	39.56	3.72	
40 – 60	22	12.5	4.6	7.9	1.67	2.8	36.76	59.4	3.84	

Where: θFc = Field Capacity (%), θwp =Wilting Point (%), A.W = Available Water (%), BD = Bulk density (g/cm3), and HC = Hydraulic Conductivity (cm/hr).

Table 2. Chemical properties of the irrigation water.

pH	EC ds/m	Soluble Cations, meq/L				Soluble Anions, meq/L			SAR
		Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}	SO_4^{--}	Cl^{-}	
7.1	0.83	1.72	0.85	4.78	0.85	2.18	0.14	5.88	4.22

Experiment layout:

The results were obtained in split plot design experiment which repeated three times. Irrigation regimes and mulching techniques were focused in the main and the sub main plot respectively. faba bean variety (G416) grown on sandy soil.

Planting of faba bean was done on the 1st week of November and the growing season produced 150 day of growth.

Mulching treatments

Three Mulch treatments (Straw Mulch (SM) , Plastic Mulch (PM) and No Mulch (NM)

Technique of irrigation and it component:

The type of irrigation was by use of surface drip. The irrigation components are the following:

Control head:

It was situated in water source supply. It is composed of centrifugal pump (Its discharge is 300 m3/h at pressure of 2 bar and 5/4 inch in diameter). This pump had a capacity of 40 horse power and the outlet hole was attached with a release pipe to regulate the working pressure. The filtration process of water that was entering the system was completed with a screen (120 meshes) that was installed on the delivery pipe of the inlet pump .

Main lines:

They are made of P V C pipe 63 mm in φ to convey irrigation water to the laterals .

Lateral lines:

They are made of PE tubes 16 mm in φ. The lateral length and space in between were 50 and 0.8 m, respectively

Dripper:

Regular drippers were placed at an interval of 0.5 m on the lateral this. At the operating pressure of 1 bar, the dripper discharge is 4 Lh-1 .

Irrigation regimes:

The four irrigation regimes were then used in plant irrigation as follows (namely 100%, 80% and 60% ETc).

The harvesting of the plants provided was done at the end of March the following year i.e. a period of 150 days was the duration of the growing season .

Total Yield :

A 1m x 1m size frame was used in assessing the total yield of each treatment. Frame was randomly positioned and the seed and straw of faba bean plants were weighted individually in the frame .

Water Use Efficiency -WUE

The term is used to describe the yield of faba beans in terms of cubic meter of irrigation water. This was computed using Israelsen and Hansen (1962) as ;

WUE=Y/W (4).

Where :

WUE = Water use efficiency (Kg m-3),

Y = Seeds yield total (Kg seed fed.-1), and

W = Water applied total (m^3)

Statistical analysis

The data were analyzed (ANOVA) in Statistic 10.0 in terms of RCBD design and Split Plot arrangement at 5% probability level. As per the treatment plan, every treatment was duplicated four times (Ryan and Morgan, 2007).

Results and Discussion

Tables 3, 4, 5, and 6 show that, all the parameters that were measured i.e. seed yield and straw yield (ton fed-1), and water use efficiency (WUE, kg m-3) were significantly influenced by the irrigation and mulching treatments. There were significant differences at all irrigation levels between the mulching treatment and the corresponding treatment carried out without mulching in irrigated yield at control, drip irrigation, and drip irrigation with mulching treatments, and WUE.

Main Effect of Irrigation Regimes:

Table 3. Main effect of irrigation regimes on Seed yield (ton. Fed.$^{-1}$), Straw yield (ton. Fed.$^{-1}$) and WUE(kg. m^{-3}).

Irrigation treatment	Seed yield (ton. Fed.$^{-1}$)	Straw yield (ton. Fed.$^{-1}$)	WUE (kg. m^{-3})
IR1	2.369b	4.690b	1.746c
IR2	2,531a	4.718a	2.430b
IR3	2.063c	3.956c	2.505a

Irrigation treatment IR2 Produced was applied on the seeds (2.875 and 5.318 ton fed.-1) and straw respectively. The yields obtained were much higher as compared to those under the use of IR1 (2,396 and 4.690 ton fed.-1) and IR3 (2.063 and 3.956 ton fed.-1) irrigation treatments. Consequently, the 80 percent of ETc should be used in the sandy soil to attain high yields of faba beans. Similar findings were attained as those of (Monay et al.2021); they showed that the decline in yield was restricted to 10-20 percent with approximately 25-50 percent decrease of irrigation water used.

With respect to the use of water Irrigation regimes may be written in the following order IR1 < IR2 < IR3 (in ascending order). The effects of the difference in yield of both the seed and straw and WUE between any two regimes of irrigations were significant at 5 percent level of significance. This is attributed to the fact that faba bean has its tolerance to water stress depending on the stage through which it is in the growth.

Main Effect of mulches on yield and straw of faba bean:

Table 4. Main effect of mulches treatments on Seed yield (ton. Fed.$^{-1}$), Straw yield (ton. Fed.$^{-1}$) and WUE(kg. m^{-3}).

Mulches treatment	Seed yield (ton. Fed.$^{-1}$)	Straw yield (ton. Fed.$^{-1}$)	WUE (kg. m^{-3})
SM	2.534a	4.928a	2.439a
PM	2,394b	4.651b	2.296b
NM	2.043c	3.785c	1.946c

Straw Mulch (SM), Plastic Mulch (PM) and No Mulch (NM))

Data in hand also showed that the seed and straw yield and water use efficiency were highly significant at all the levels of irrigation in mulched and unmatched treatments. Mulches played a positive considerable role on the yield and the effect was more prominent on lower water regime treatment than on higher water regime treatment. The maximum probability was discovered in all parameter of growth by use of drip irrigation with mulches. The yield of seed and straw between mulches treatment was found to be statistically equal. Nevertheless, in Straw Mulch (SM), yield was just a bit higher.

Irrigation Regime × Mulches treatment

Table (5): interaction between irrigation regime and mulches treatment on studied traits.

Irrigation treatment	Mulches treatment	Seed yield (ton. Fed.$^{-1}$)	Straw yield (ton. Fed.$^{-1}$)	WUE (kg. m^{-3})
IR1	**SM**	2.53c	4.932c	1.845g
	PM	2.42d	4.813d	1.768h
	WM	2.23e	4.325f	1.626i
IR2	**SM**	2.87a	5.318a	2.771a
	PM	2.62b	5.021b	2.526d
	WM	2.06h	3.816h	1.993f
IR3	**SM**	2.223f	4.534e	2.701b
	PM	2.13g	4.120g	2.595c
	WM	1.831i	3.216i	2.220e

Table (5) Results indicated significant results of all tested variables on faba bean yielding. SM produced similar performance at each level of irrigation and PM produced much better when 60 per cent ETc was satisfied by drip system. Evaporation on the surface of the soil was very low in case of PM in comparison to SM. This has led to lack of aeration high moisture regime below the PM, which may not augur well towards providing higher yield and water use efficiency. Table_(5) demonstrates that WUE does not only change with irrigation regimes but also with mulches. Irrigation mulches resulted in increased WUE as compared to irrigation only when applied under any degree of irrigation. Even greater impact of the mulches on the WUE was found when it was used in combination with the lower irrigation regime. Irrigation to faba bean plot mulched with polythene performed better at 60% irrigation level of the ETc.

Parameters between any two interactions were significant at the 5 percent level till the maximum values were got with the inter-action IR2x SM and the min heterogeneous parameters were got with the interaction IR3x WM. All the irrigation treatments with mulch owed up to have higher yield and straw as compared to unmatched drip irrigation treatments. The productivity of faba bean enhanced with the increment of water availability devoid of mulch. It was the opposite in the case of drip irrigation combined with polyethylene and straw mulch; faba bean yield declined as the amount of irrigation regime rose. This finding correlates with that of (El-Beltagi et al., 2022).

The best WUE was recorded when (IR2 16.771 kg/m^3) was combined with (SM 2.771 kg/m 3), but very near to it was IR3X SM (2.701 kg/m 3). The least WUE was in IR1 × WM (1.626 kg/m 3) as a result of high input of water and low production (Kader et al. 2017): The study showed that mulching in deficit or moderate irrigation resulted in a significant improvement in WUE because evaporation and runoff were decreased. reported that moderate irrigation x mulch recorded an optimum WUE in legumes as it resulted in MS increase in moisture of the root zone and a decrease in water loss (Imam and Sabreen, 2019).

Seed Weight per Plant (g):

The greatest seed weight/plant was obtained under IR2 x SM (40.8 g), so moderate irrigation (IR 2) and straw mulch (SM) are optimal in seed development. The lowest value was found with IR3 x WM (26.3 g) indicating that the presence of water stress (IR3) and lack of mulch (WM) had the proverbial least favored effects in to this result is in line with (Abdelkhalek et al., 2020)who reported that medium level of irrigation enhances seed maturation and the ultimate productivity. And in the same tune, (El-Beltagi et al.,2022; Pibars and Mansour 2015) availed that conditions of organic mulch coupled with sufficient moisture positively impacts grain filling. Nevertheless (Bekele,and Mengasha, 2023) proposed that in some circumstances, complete irrigation would lead to increase in seed weight albeit not efficiently.

Number of Seeds per Plant:

Ir2 x SM (60.2 seeds) was again the best as it was followed in seed weight, and IR3CWM (26.5 seeds). The latter further indicates that a deficit on water supply with the absence of mulch greatly minimizes producing reproductive outputs. This is in line with (Ahmed et al.,2020) that reported that the deficit irrigation in mulch contributed to pod and seed set. The above statement was also remodified by (Pibars et. al.,2015) verifying that the application of mulching to soil decreased water losses and heat stress that enhanced seed setting. Quite on the contrary, (Verma and Pradhan (2024) observed that even resorting to mulching may fail to increase the number of seeds substantially when the terrain is drought-stricken unless there is a way to improve the quality of the soil.

Number of Pods per Plant:

Both full and moderate irrigation are positive arrangements when straw mulch is supplied as the number of pods was maximized under IR1 x SM (17.10), followed by IR2 x SM (16.70). (Ahmed et al. 2020) also agree that mulching enhances pod formation due to stabilization of soil moisture and temperature. It was shown that the population abortion of pods in dry conditions with the use of mulch is still higher in the sensitive genotype (Mansour et al., 2015).

Branches/plant:

A higher number of branches (5.11) was recorded on IR2 x SM, which means improved vegetative growth. This concurs with (El Beltagi et al., 2022), who explained that moderate watering with mulch enhances branch initiation. Sabreen and Mansour (2015) verify that the fertilization of soil microclimate by mulch stimulates shoot growth. Excess mulch however was reported has been reported to inhibit branching in poorly drained soils (Bekele and Mengasha,2023).

Table 6. Interaction between irrigation regime and mulches treatment on studied traits.

Irrigation treatment	Mulches treatment	Seed weight per plant (g)	No. of seeds/ plant	No. of pods/plan	No. of Branch/plant	Plant height (cm)	100 Seed wt. (g)
IR1	SM	39.12ab	58.98a	17.10a	4.27c	94.8b	40.4b
	PM	35.23c	50.89c	14.20b	4.01d	92.4c	39.7c
	WM	31.43e	40.21d	12.23e	3.00g	79.7e	31.5f
IR2	SM	40.8a	60.24a	16.70a	5.11a	99.4a	43.8a
	PM	38.3d	53.13b	14.54b	4.67b	92.7c	40.1b
	WM	30.22f	31,45f	12.87d	3.21f	78.8f	29.8g
IR3	SM	31.68e	41.45d	13.76c	3.93e	86.8c	34.8d
	PM	28.96g	35.01e	11.93f	2.96h	82.5d	33.9e
	WM	26.32h	26.54g	11.30g	2.60i	76.9g	25.6h

Discussion

A systematic deficit irrigation is a good way of conservation of irrigation water and maximum production is achieved through the increment of irrigation water which positively influences water productivity of crops. This finding tallies with the ones made by (Tayel and Sabreen in 2011, and Imam et al. in 2025).

They demonstrated that, moderate irrigation prevents waterlogging and at the same time keeps soil moisture at optimum levels that guarantee faba bean production (Abdelkhalek et al.2020). As previously mentioned, moderate irrigation has been demonstrated to encourage development of the shoot on legumes, particularly in the presence of an organic mulch, which maintains the rhizosphere to be wet (Monay et al.,2021).

The effect of mulches on faba bean yields was higher than the respective rate of drip irrigation without mulches. Organic mulching contributes nutrients and to the Soil and its physical effects like conservation of water and maintenance of temperature. Positive effects of mulch on the growth and yield of vegetable crops have also been discussed by numerous researchers (Kaur et al., 2021; Hailu Demo and Bogale, 2024).

Straw mulch application also increases above-ground biomass via the decrease of physiological stresses and an increase in soil structure. (Ahmed et al. 2020) emphasised that mulch application of straw improved total biomass by prolonging the period when crops could access moisture in the root zone, but even more, it increased the yield of seeds of the leguminous crops because it allowed them to conserve moisture and improve the activity of their roots. (Huang and Zhang, 2020) pointed out that straw mulch minimised soil temperature variations and ev The presence of straw mulch between the soil and the air can avoid the loss of water by evaporating. This cuts the number of frequent irrigation thus saving a lot of water. Also, straw mulching is able to enhance soil structure, aeration and the availability of nutrients which will result in healthier and more productive crop .

According to (Singh et.al.,2021), Mulches helped slow down the process of water loss in the form of evaporation. Therefore soil-water-plant association was more favorable in low irrigation regime as compared with high irrigation regime which should facilitate the realization of high yield hence higher WUE. Similarly, maximum WUE was associated to low irrigation regime treatment in drip alone treatment. Generally, trend lines of the WUE in terms of the total water used to treat the different drips were such that the less the number of water taken, the greater was the WUE. In addition, the deep percolation was decreased and use of water in the root zone soil was increased by low irrigation regime (Sachin et al. 2024).

The findings of this study confirm that straw mulch (SM) significantly enhances faba bean yield and water use efficiency compared to plastic mulch (PM) under drip irrigation. This improvement is attributed to SM's gradual decomposition, which enriches soil organic matter and fosters microbial activity, thereby enhancing soil fertility and nitrogen fixation (El-Beltagi et al., 2022; Kaur et al., 2021). Moreover, SM regulates soil temperature more effectively than PM, reducing heat stress during sensitive growth stages (Verma and Pradhan, 2024).

SM also improves water infiltration and moisture retention in the root zone, contributing to better soil–water relations and higher productivity under limited irrigation (Hailu Demo and Bogale, 2024). In addition, its biodegradability and low environmental impact make it a more sustainable option compared to PM, which poses challenges related to disposal and soil contamination (Chen et al., 2023).

In this bulletin, Ratable the use of irrigation water, We also raise some questions on why the loss of irrigation water at the farm occurs and focus on its smart management by knowing the factors that help in the process of rationalizing the use of irrigation water, (Mansour et al., 2019a-e, Hu et al., 2019, Abdalla et al., 2019, Jiandong, et al, 2019, Abd-Elmabod et al, 2019a-b, Tayel et al 2019a-c, Hellal et al, 2019,

For these projects, large quantities of water are needed which can only be achieved by enhancing irrigation efficiency, salvage water re-use and salvage water treatment on unwatered "old lands", (Hellal, et al 2021, Gaballah, et al, 2020, Pibars, et al., 2020, and Mansour, et al, 2020a-d, Mansour, and Aljughaiman, 2020).

In this way, in terms of resource-efficient and climate-resilient agriculture and in arid and semi-arid areas in particular, the IR2 x SM treatment presents a realistic and balanced solution aimed at increasing the performance of crops and saving irrigation water. The results are very useful in sustainable agriculture, and particularly arid regions, (Kibria et al., 2024; Bekele and Mengasha, 2023), (Hailu and Bogale, 2024 and Abd-Elhakim et al.,2021), (Imam et al. 2025), (Ali,2023), (Wang et al., 2024), (Bayisa et al., 2024 and Abdelaal 2023).

The water management issue related to enhancing the yield of faba beans in arid and semi-arid areas under salinity and water shortages is sustainable. Abd El Hady et al., (2025) proved that seed germination and crop establishment is severely affected by irrigation water salinity, which is crucial in terms of incorporating soil mulching using the drip irrigation to increase the water-use efficiency. Mansour (2025) applied the AquaCrop framework in drought and contemporary irrigation conditions to provide insights which can be potentially generalized to legume systems including faba bean.

In their broad review, El-Ramady, el al., (2024) highlighted that incorporating water saving irrigation methods and amending of soils is essential in reclaiming saline soils- this method applies more to the production of faba bean in stressed conditions. Further, Mansour et al., (2024) examined physiological adaptation to salinity stress in Jatropha plants, which found the mineral balance- an observation that corresponds with nutrient and water interplays in faba bean systems. Besides, Mansour et al. (2024) found that the use of localized irrigation systems along with humus compound fertilizers had a significant positive impact on yields in sandy soils, also proving the effectiveness of mulching and drip strategies in terms of sustainable production of faba bean.

Conclusion:

The results have made it quite clear that the influence of irrigation regimes as well as mulch treatment results in a significant change in faba bean seed yield, straw yield and water use efficiency (WUE). The high values of seed, straw yield and WUE (2.875 ton/Fed, 5.318 ton/Fed, and 2.771 kg/m 3 respectively) were consistently recorded under combination of moderate irrigation

(IR2) and straw mulch (SM). This reflects on the significance of having proper level of moisture in the soil and at the same time not wasting water, which gets well maintained in case of organic mulching. The beneficial grandparents are due to increased moisture preservation, stabilised soil temperature, and increased physiological activity at low water pressure.

Conversely, the worst performance of all traits was noted under severe water stress (IR3) in the absence of mulch (WM), and this fact demonstrates that mulch is critical to alleviating the negative impacts of the lack of irrigation. The results indicate that moderate irrigation level plus straw mulch can be adopted as sustainable measure in enhancing yield and water productivity in faba bean especially where water is scarce.

Straw mulch (SM) proved to be better than plastic mulch (PM) in increasing the yield and the water use efficiency of faba beans with drip irrigation. SM enhanced the fertility of the soil, soil moisture and temperature, with moderate benefits and serious environment challenges to PM. Therefore, SM offers a better and sustainable solution as far as mulvising in water-limited environments is concerned.

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