Application of Increasing Yield and Quality of Melon Crops Subjected to Regulated Deficit Irrigation

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Abstract: Over the past half-century, China's irrigation technology has gradually stepped from simply translating and imitating foreign advanced technology to specific China-style irrigation technology characterized by distinctive features, local conditions-orient and inheritance reform. In the context of global warming, regulated deficit irrigation technology is also crucial to attenuate the emission and absorption of key greenhouse gases at the farmland scale. Based on the state-of-the-art research of regulated deficit irrigation technology, the influence of the regulated deficit irrigation technology on the growth of crop, yield, water use efficiency, and quality of melon crops were investigated. The internal mechanism of increasing yield and regulating the quality of regulated deficit irrigation technology system was clarified. Finally, the shortcomings and limitations in the development, demonstration and promotion of regulated deficit irrigation technology were analysed, and the idea by combining regulated deficit irrigation technology with modern information technology was proposed, which would serve as an important guidance for the development of agriculture in future. Hopefully the present work can provide theoretical support for the sustainable development and system management of dry land agriculture systems.

1 INTRODUCTION

Water resources not only affect the global ecological environment, but also as an important strategic resource for human survival and development, the amount of which directly affects the social process. With a series of natural pressures increasing, such as global warming, increasing population and serious soil desertification, the contradiction between supply and demand of water resources has become increasingly prominent. Therefore, the supply-demand relationship of water resources has become the focus of current social attention. The total amount of water resources in China ranks sixth in the world. However, due to the large population, the per capita water resources are only 1/3 of the global per capita water resources, ranking 110th in the world, and the per capita water demand is seriously insufficient (Huang 2020). At the same time, China is also a large agricultural water consumption country. In 2020, China's agricultural water consumption accounts for about 65% of the total water consumption in the country. However, due to the obsolete irrigation facilities and unreasonable irrigation system, the utilization coefficient of irrigation water is only 0.55, which are significantly lower than that of developed countries.

Melon crops are important economic crops and are widely cultivated worldwide, including pumpkin, melon, watermelon, cucumber and squash. In China, the planting area of melon crops reached 2.11×107 hm^2 in 2018, with significant economic benefits (CSY 2020). Water consumption of melon crops in the growth stage is large, and the requirement for soil moisture is high. Water supply directly affects the growth and development of melon crops and the output and quality of fruit. Therefore, appropriate field management can bring greater economic benefits. With the improvement of people's quality of life, there are also higher requirements for the quality

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of melon and fruit. Especially in the cultivation of melon crops in arid areas, how to use the least water resources to ensure the maximum output and quality is the focus of attention of scholars in China and abroad, and a lot of achievements have been made. This paper reviews the research status and progress of melon crops under regulated deficit irrigation.

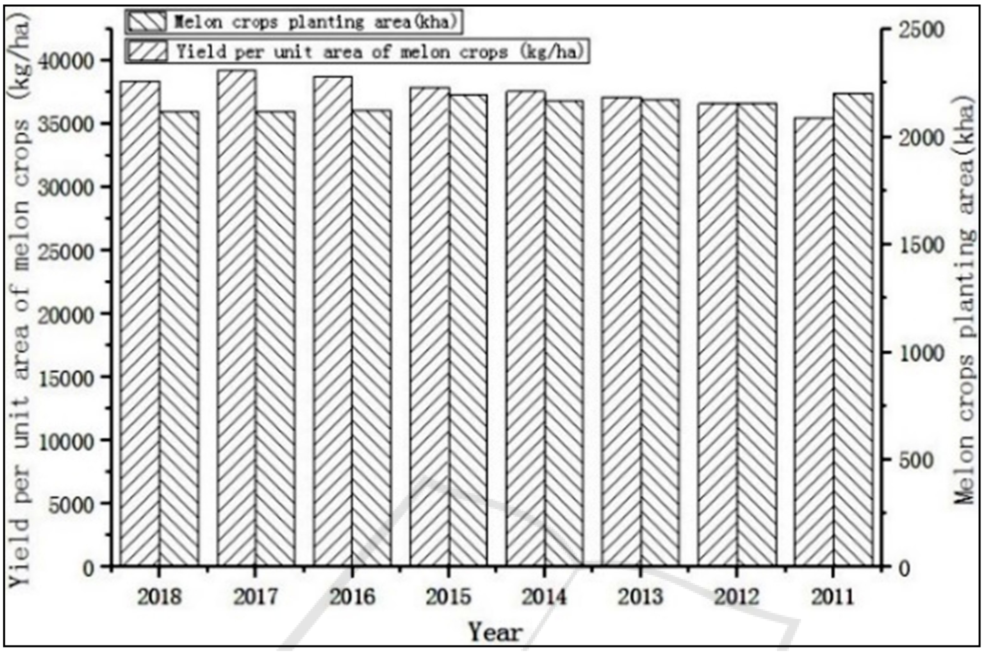

Figure 1: The planting area and yield per unit area of melon crops.

2 RESEARCH STATUS ON THE MECHANISM OF RDI

Regulated deficit irrigation is an irrigation technology developed on the basis of insufficient irrigation. Through the control of soil moisture at a certain growth period of crops, crops are subjected to a certain degree of water stress, and then registered at the subsequent growth stage. After treatment, crops can not only improve the late drought resistance, but also affect the redistribution of crop photosynthetic products to different tissues and organs, and reduce the growth redundancy of vegetative organs, to achieve the purpose of water-saving and yield increase. Without the influence of other factors, crops can maintain a relatively stable growth state within the appropriate water range. When water deficit is regulated at a certain growth period, crops transfer nutrients from other organs to stress organs through self-regulation. Physiological and biochemical changes occurred in crops during water stress. Adjusting soil moisture and timely guidance can provide conditions for improving water use efficiency, increasing crop yield and quality (Ma 2005).

Under the condition of regulated deficit irrigation, the root is the main organ to transmit water stress information. In the theory of regulated deficit irrigation, it is believed that the root plays a decisive role in improving the water use efficiency in a crop growth period. In the theory of root-shoot functional balance, the relationship between crop roots and crowns is both interdependent and competitive. Under the premise of farmland microclimate stability, the ratio of root to the crown is also in a relatively stable state, which is caused by genetic factors of crops themselves. When the farmland microclimate is in a state of turbulence, the relationship between root and crown has changed from the original interdependence to mutual competition. Crops can automatically transfer nutrients from other parts to the organs most in need of nutrients through their regulation, so that the damage to crops will be minimized. When the root feels water deficit, the proportion of photosynthate between root and crown will be redistributed within the crop. More photosynthate will be obtained in the root, which is more favourable for the growth of the root. However, crown growth is inhibited due to the transfer of generalising crops, thereby reducing the leaf area and reducing the transpiration water consumption of crops, thereby causing the decrease of water demand (Cai 2004). The results showed that when regulated deficit irrigation was carried out, the soil was in a state of water shortage. It was difficult for crop roots to absorb water, and the water supply of the aboveground part was insufficient. The relative water content and water potential of crop leave decreased, and a substance that could control the opening and closing of leaf stomata was produced, which affected the physiological processes such as photosynthesis and transpiration of crops, and ultimately affected the water use efficiency and yield of crops (Blackman 1985, Chalmers 1984a, Chalmers 1984b).

Regulated deficit irrigation can effectively reduce soil evaporation while reducing crop transpiration. When the crop is in a deficit period, the soil moisture decreases. The water content of the surface soil is below the capillary fracture water content, and the water in the lower soil is only transferred to the atmosphere through the upper dry soil in the way of water vapor diffusion, reducing water waste (Mohamed 2013). A large number of studies have shown that abscisic acid (ABA) is the main transmission signal to control the stomatal aperture of leaves. When the root water absorption of crops is inhibited, the ABA signal in the xylem is transmitted to the leaves, which reduce the stomatal aperture of leaves and greatly reduce the physiological water consumption of crops (Pang 2005).

In recent years, the research work of regulated deficit irrigation has changed from improving crop yield to improve crop quality. Regulated deficit irrigation has changed the distribution of photosynthetic products, promoted its reproductive growth, improved the quality of fruit, and improved the sugar content and storability of fruit. Many studies have shown that the contents of soluble sugar and organic acids in fruit under regulated deficit irrigation were significantly higher than those under normal irrigation, which improved fruit quality. Soluble solids, K^+ and organic acids in the fruit reduced the water potential of fruit cells, promoted the transfer of cells from external water absorption and nutrients to fruit, enhanced the ability of the fruit to compete for nutrients and water, and promoted the growth rate of fruit after rehydration (Chalmers 1986, Cai 2000, Cheng 2003, Mills 1996).

3 RESEARCH PROGRESS OF MELON CROPS SUBJECTED TO RDI

3.1 Effects of RDI on Growth of Melon Crops

Water deficiency at the vegetative growth stage of plants can reduce the water content of growth tissue and constitute cell expansion pressure, thus significantly affecting morphological indexes such as stalk height, stem thick, root length and foliage area. Yuan et al. obtained through the experiment of regulating water deficit of drip irrigation melon in the greenhouse that in the vegetative growth period, with the increase of water deficiency degree, the stalk height, stem thick, root length and foliage area all showed a decreasing trend. In the fruit development stage, the water deficiency in the vegetative growth period and reproductive growth period had an impact on the growth and yield of fruit, which decreased with the increase of water deficiency degree (Yuan 2015). Chang, the water deficit experiment of greenhouse cucumber showed that for morphological indexes, the number of leaves and plant height was the best in control. With the extension of water treatment time, the stem diameter was always A3 and A2, and the number of leaves and plant height was always the best in control. Water stress inhibited the vegetative growth of cucumber plants to a certain extent, thereby promoting the transportation of assimilation products to reproductive organs (Chang 2007). Wang showed that the experiment of water deficiency regulation on watermelon in an oasis showed that water deficiency at different growth stages and different levels could inhibit the growth of the main vine, leaf number, leaf area, stem diameter, flower number and root system of watermelon. After the end of mild water deficit, the vine, stem, leaf, root and other parts of re-watered watermelon could obtain compensatory growth. The difference between re-watered watermelon and the control treatment with sufficient water supply was reduced or close to the control level (Wang 2007). In the experiment of regulating deficit of muskmelon in greenhouse, Zhang et al. was found that the growth of stem diameter and plant height of muskmelon was slow with the increase of water deficit, and the reproductive growth period was delayed. The stem diameter and plant height of T1 treatment were always the largest, and the growth of T4 and T5 treatment was deliberate. All treatments showed slow growth, rapid growth and slow growth (Zhang 2014). The study on pumpkin in Hexi oasis of Yang showed that the growth rate of pumpkin vine length and stem diameter changed rapidly in the early stage and slow in the middle and late stage. Water deficit at the vine extension stage would seriously influence the vine length, stem diameter and leaf area index of crops. Water deficit in the late growth stage inhibited the dry matter accumulation of pumpkin, which would lead to cropping yield reduction, but mild deficit had no significant effect (Yang 2016).

3.2 Effects of RDI on Yield and WUE of Melon Crops

A large number of relevant research reports have proved that timely and appropriate deficit irrigation will not cause crop yield reduction, but will help increase crop output and improve WUE. In the experiment of regulated deficit irrigation for melon in greenhouse, Zhang et al. was found that the water content was the same as the early growth stage, and the increase in irrigation amount to the late growth stage could significantly improve the yield of melon. Compared with T2 and T5, the irrigation amount of T1 and T4 increased by 44.5 and 29.8%, and the yield increased by 17.1 and 23.7%. When the water content was constant at the late growth stage, the increase in irrigation at the initial growth stage also significantly increased the yield of melon. Compared with T4 and T5, the irrigation amount of T1 and T2 increased by 26.2 and 13.3%, and the yield increased by 24.0 and 30.2%. Therefore, in the case of water deficit at late growth stage, the increase of irrigation amount at an early growth stage is more important for the formation of melon yield. The WUE of T2 treatment was the highest, and its irrigation amount decreased by 12.7% compared with T4 treatment, but the yield increased by 5.3% and the water use efficiency increased by 20.5% (Zhang 2014). The results of Khalili Mikaiel et al. showed that the output of pumpkin seeds under water deficit was the best at grain filling stage (Khalili 2021). Taia A. Abd El-Mageed et al. found that it was found that under 85% ETc deficit irrigation, the yield and water use efficiency of pumpkin were the highest in autumn, with water consumption reduced by 36% and yield increased by 19%. The average WUE of 85% ETc was 11.16% and 14.19% higher than that of 70% ETc and 100% ETc, respectively. 85% ETc is the optimal irrigation strategy (Taia 2015). The results of Zheng et al. showed that the yield of watermelon was the lowest (114.13g) under moderate water deficit at seedling and fruit enlargement (0.5ep, ep was daily evaporation value) and mild water stress at maturity (0.75ep). The yield was the second (120.9g) under mild water stress at flowering and fruit setting (0.75ep) and moderate water deficit at fruit enlargement and maturity (0.5ep), which was 27.57 and 23.27% lower than that of normal irrigation 157.57g, respectively. The yield of watermelon decreased under continuous water deficit at the growth stage (Zheng 2009).

The results of many years of research by Abdelkhalik et al. showed that compared with 100% irrigation rate, the total yield of water stress at different growth stages of watermelon showed a downward trend. Underwater stress of 75% irrigation rate, the yield per square meter and single fruit weight, Marketable yield, and large fruit of watermelon at the elongation stage, fruit expansion stage and maturity stage were the lowest, which were $4.25kg\cdot m^{-2}$, $4.11kg\cdot fruit^{-1}$, $2.19kg\cdot m^{-2}$, and 0.0, respectively. The water stress during the whole growth period of watermelon decreased the above indexes, indicating that the continuous water stress was unfavourable, and the yield was formed during the growth and development of watermelon (Abdelkhalik 2018). Jiang et al. showed that the average yields of the deficit treatments at the elongation stage and the fruiting stage were significantly decreased by 16.0% and 20.5% compared with those of the full irrigation treatment, respectively. However, there was no significant difference between the yields of the deficit treatments at the two stages (Jiang 2015). Water deficit experiment of melon in the greenhouse by Huang et al. showed that compared with full irrigation, fruit yield of melon decreased by 25%, 24% and 27% respectively and water use efficiency decreased by 19%, 11% and 18%, respectively under mild, moderate and moderate water stress treatments in vine extension period and fruit enlargement period, and the effect of mild water stress treatment in fruit enlargement period was the best (Huang 2016). Du et al. showed that the highest yield and water use efficiency of cucumber could be achieved by controlling the soil moisture of 80%~90% field capacity at flowering stage, 80%~90% field capacity at early melon stage, 90%~100% field capacity at full melon stage and 70%~80% field capacity at later stage. The demand for water reached the peak of the whole growth period, and the transpiration rate reached 3.83mm/d (He 2003).

3.3 Effect of RDI on Quality of Melon Crops

Water stress can promote the accumulation of secondary metabolites in crops, thereby improving the quality of harvested products to a certain extent. Hamzei J et al. set different gradients for irrigation and nitrogen fertilizer as factors. Results showed that under the conditions of irrigation 600mm/ha and application 390kg/ha, the linoleic acid (33.99%), fruit yield (4.40kg/m^2), grain yield (1.53kg/m^2) and agronomic nitrogen use efficiency of pumpkin reached the highest value (Hamzei 2016). Kirnak H. et al. studied the effect of water deficit on the chemical composition of pumpkin seeds. The results showed that irrigation level had a significant effect on the oil content of pumpkin seeds, and the oil content of each treatment ranged from 26% to 64%. Deficit irrigation had a significant effect on protein, fatty acid and vitamin E content (Kirnak 2019). The results of regulated deficit irrigation of watermelon under drip irrigation by Liu et al. showed that watermelon under medium frequency irrigation at seedling, high frequency irrigation at flowering and fruit setting, medium frequency irrigation at fruit expansion, and low frequency irrigation at maturity had a high content of total vitamin C, the highest content of soluble protein, and central edge soluble solids (Liu 2014).

Omotade I.F. et al. found that the average length and average diameter of cucumber fruit under mild water deficit conditions were 18.33cm and 5.87cm, respectively. The appearance quality was the best (Omotade 2019). The results of deficit irrigation experiment on melon in plastic shed of Wang showed that compared with full irrigation, the photosynthetic rate did not change significantly under mild water deficit treatment of fruit expansion stage. The transpiration rate and stomatal conductance increased by 8% and 75%, respectively. The irrigation amount per planting decreased by 6%. The water use efficiency and pulp hardness increased by 8% and 10%, respectively. The solid-acid ratio increased, and the yield had no significant difference (Wang 2011). Jiang et al. studied the effect of regulated deficit irrigation on the quality of Hetao muskmelon. The results showed that compared with thorough irrigation treatment, the total sugar, soluble solids and vitamin C of the muskmelon under regulated deficit irrigation were at a higher level. Compared with the early growth stage, the content of total sugar and vitamin C of the muskmelon under regulated deficit irrigation in the late growth stage was significantly increased, but the water content of the muskmelon was reduced. Regulated deficit irrigation decreased the average pulp thickness and average seed cavity diameter of melon. In the respective deficit treatments at the elongation stage and the fruiting stage, titratable acid of melon gradually increased with the increase of water deficit, and the pH value showed a downward trend with the increase of the deficit level (Jiang 2016).

4 PERSPECTIVES AND PROBLEMS

RDI technology is a low-cost and high-efficiency water-saving irrigation technology, which has brought great benefits to the economy and ecology, so it has a good application prospect. To make full use of water resources, achieve the purpose of precision irrigation. Play the role of new water-saving agriculture in modern agriculture. However, there are still some problems to be further studied in the deficit irrigation technology of melon crops.

(1) Under different soil conditions in different regions, the research on the water demand law of melon crops is insufficient. It is necessary to study the response mechanism of melon crops to water stress under different conditions in-depth to obtain the most suitable irrigation mode, deficit regulation period, deficit regulation degree and irrigation amount, especially in the arid areas with sufficient sunshine.

(2) Strengthening water and fertilizer coupling, water and heat coupling research of melon crops, forming a complete theoretical system, to achieve high yield, high quality and economic benefits under the premise of water and fertiliser efficient utilisation, water and fertiliser saving effect.

(3) In the process of regulated deficit irrigation for melon crops, soil moisture, crop physiological and ecological indicators should be added as indicators for quantification, which is convenient for control in the process of regulated deficit irrigation and can reflect the impact on crop yield and quality. In addition, it is necessary to increase the quality detection indexes to further illustrate the improvement of fruit quality, such as amino acids, proteins and β-carotene.

(4) For regions lacking irrigation water resources, brackish water, domestic sewage or industrial wastewater can be used to irrigate, and the corresponding reasonable deficit irrigation theory can be explored. Have shown that an appropriate amount of brackish water treatment can improve fruit quality in the late growth stage of crops (Qiao 2007, Xiao 2003), which are helpful to solve the contradiction between supply and demand of water resources, and the reuse of brackish water, sewage and wastewater.

(5) Combining science and technology with cucurbit crop planting management, such as artificial

intelligence technology and 3S technology, the growth dynamics, soil moisture, environmental conditions and climatic factors are monitored in real-time to reduce artificial investment and improve management efficiency.

5 CONCLUSIONS

Melon crops have advantages such as large planting scale, short growth cycle, well economic benefits. Thus, they can significantly increase farmers' income. The aforementioned results demonstrated that mild water deficit during fruit expansion could effectively improve fruit quality and water use efficiency without compromising yield. In summary, regulated deficit irrigation can help to improve water use efficiency, fruit yield and quality during the cultivation of melon crops. Further progress has been made in the effective allocation of water resources. In addition, by combining with modern information technology, this work proposed a feasible and easy-to-promote deficit regulated irrigation technology system, aiming to establish a green and sustainable agricultural model.

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REFERENCES

Abdelsattar, A., Nuria, P. S., Inmaculada, N., Alfonso, G., Carlos, B., & Bernardo, P. (2018). Yield response of seedless watermelon to different drip irrigation strategies under mediterranean conditions. Agricultural Water Management., 212: 99-110.

Blackman, P. G., & Davies, W. J. (1985) Root to shoot communication in maize plants of the effects of soil drying. Journal of Experimental Botany., 1: 39-48.

Cai D. X., Shen N. Z., Cui Z. C. (2004) Research advance of effects of regulated deficit irrigation on physiological and ecological characteristics of crops. Journal of Northeast Agricultural University., 02: 239-243.

Cai H J, Kang S Z, Zhang Z H, Chai H M, Hu X T, & Wang J. (2000) Proper Growth Stages and Deficit Degree of Crop Regulated Deficit Irrigation. Transactions of The Chinese Society of Agricultural Engineering., 03: 24-27.

Chalmers, D. J. , Mitchell, P. D. , & Jerie, P. H. . (1984). The physiology of growth control of peach and pear trees using reduced irrigation. Acta Horticulturae., 146: 143-150.

Chalmers, D. J., Burge, G., Jerie, P. H., & Mitchell, P. D. (1986). The mechanism of regulation of 'bartlett' pear fruit and vegetative growth by irrigation withholding and regulated deficit irrigation. Journal of the American Society for Horticultural Science (USA)., 111(6): 904-907.

Chalmers, D. J., Mitchell, P. D., & Jerie, P. H. (1984) The physiology of growth control of peach and pear trees using reduced irrigation. Acta Horticulturae., 146: 143-150.

Chang L. F. (2007) The Effects of RDI on the Growth, Production and Fruit Quality of Greenhouse Cucumber. Northwest A&F University.

Cheng F. H., Li S. H., & Meng S. Q. (2003) Study on the Effect of Regulated Deficit Irrigation on the Vegetative Growth, Cropping and Fruit Quality of Yali Pear Variety. Journal of Fruit Science., 001: 22-26.

Hamzei J, Babaei M.& Khorramdel. S.. (2016) Effects of different irrigation regimes on fruit production, oil quality, water use efficiency and agronomic nitrogen use efficiency of pumpkin. Būm/shināsī-i kishāvarzī., 7(1).

He S. N., Liang Y. L., Zhang C. E. (2003) Effect of soil moisture on water requirement rule and water use efficiency of cucumber in greenhouse. Acta Botanica Boreali-Occidentalia Sinica., 08:1372-1376.

Huang H. B. (2007) On China's Water Resource Utilization and Sustainable Development of the Economy Society. Northwest A&F University,2007.

Jiang G. Y., Yang P. L. Ren S. M. Zheng F. J. He X. Yu H. L. (2016) Effects of Regulated Deficit lrrigation on Fruit Quality of Hetao Muskmelon under Drip lrrigation. Journal of Irrigation and Drainage., 35(10): 64-68.

Jiang G. Y., Yang P. L., Ren S. M., He X, Yu H. L., Zheng F. J. (2015) Effect of regulated deficit irrigation on soil water-salt distribution and fruit yield of Hetao muskmelon under drip irrigation. Journal of China Agricultural University., 20(06): 198-204.

Khalili Mikaiel, Nejatzadeh Fatemeh. (2021) Effect of deficit irrigation and kaolin clay on yield and yield components of pumpkin (Cucurbita pepo L.). SN Applied Sciences., 3(5).

Kirnak, H., Irik, H. A., Sipahioglu, O., & Unlukara, A. (2019). Variations in oil, protein, fatty acids and vitamin e contents of pumpkin seeds under deficit irrigation. Grasas y Aceites, 70(2): 301.

Liu L. H., Mo Y. L., Yang X. Z., Li X. L., Wu M. M., Zhang X, Ma J. X., Zhang Y, Li H. (2014) Reasonable drip irrigation frequency improving watermelon yield and quality under regulated deficit irrigation in plastic greenhouse. Transactions of the Chinese Society of Agricultural Engineering., 30(24): 95-104.

Ma F. S., Kang S. Z., Wang M. X. (2005) Research advance and prospect of regulated deficit irrigation on fruit trees. Agricultural Research in the Arid Areas., 04:225-228.

Mills, T. M., Behboudian, M. H., & Clothier, B. E. (1996) Water relations, growth, and the composition of 'braeburn' apple fruit under deficit irrigation. J. amer. soc. hort, 121(2), 286-291.

Mohamed Ghrab, Rim Zitouna, Mehdi Ben Mimoun, Mohamed Moncef Masmoudi & Netij Ben Mechlia. (2013) Yield and water productivity of peach trees under continuous deficit irrigation and high evaporative demand. Biological Agriculture & Horticulture., 29(1).

National Bureau of Statistics of China. (2020) China Statisticl Yearbook. China Statistics Press, Beijing.

Omotade I.F, Babalola I.A. (2019) Assessment of Yield and Fruit Quality of Cucumber (Cucumis sativus) under Deficit Irrigation in the Agro-Ecological Tropical Zone. International Journal of Engineering Science and Application.

Pang X. M., Kang S. Z. Wang M. X., (2005) Theory and technology research development and prospect of regulated deficit irrigation on crops. Journal of Northwest A & F University (Natural Science Edition)., 06:141-146.

Qiao F., Zou Z. R. (2007) Effects of brackish water irigation on growth and distribution of salty ions in different organs of melon under sand culture. Journal of Northwest A & F University (Natural Science Edition)., 08: 114-120.

Taia A. Abd El-Mageed, Wael M. Semida. (2015) Effect of deficit irrigation and growing seasons on plant water status, fruit yield and water use efficiency of squash under saline soil. Scientia Horticulturae., 186.

uang Y., Wang W. J, Wang L. W., Xu Q. B.., Kong Q S, Bie Z L. (2016) Effects of regulated deficit irrigation on photosynthetic characteristics, fruit yield and quality of melon under plastic green house conditions. Journal of Huazhong Agricultural University., 35(01): 31-35.

Wang F. (2007) Study of Water Use and Quality Watermelon under Regulated Deficit Irrigation Condition in Arid-Hungriness Oasis Area. Northwest A&F University.

Wang W. J. (2011) Effects of Root Zone Volume and Regulated Deficit Irrigation on Physiological Characteristics and Fruit Quality of Melon. Huazhong Agricultural University.

Xiao J., Wang J. P., Liu Z. Z., Li G. Y., Zhang J. G., Mao J. H. (2003) Experimental investigation into effects of drip irrigation with saline groundwater on water use efficiency and quality of honeydew melons in Hetao Region, Inner Mongolia. Transactions of the Chinese Society of Agricultural Engineering., 02: 80-84.

Yang X. T. (2016) Effect of Different Water Supply on Water Consumption and Yield of Pumpkin (Cucurbita moschata Duch.) in Hexi Oasis Region. Gansu Agricultural University.

Yuan B. Z., Zhang Q. Y., Bie Z. L. (2015) Effects of regulated deficit irrigation on growth of drip-irrigated muskmelon in greenhouse. Journal of Drainage and Irrigation Machinery Engineering. , 33(07): 611-617.

Zhang Q. Y., Yuan B. Z., Bie Z. L. (2014) Effects of Regulated Deficit lrrigation on Growth, Yield and Water Use Efficiency of Muskmelon in Plastic Greenhouse. Journal of Irrigation and Drainage.,33(Z1): 90-93+111.

Zheng J, Cai H. J., Chen X M., Wang J. (2009) Effect of Regulated Deficit Irrigation on Water Use Efficiency and Fruit Quality of Mini-Watermelon in Greenhouse. Journal of Nuclear Agricultural Sciences., 23(01):159-164.