

Research Application Summary

Time of harvesting petals influence on carthamin and carthamidin content and yield components in safflower: A review

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Abstract

Safflower (*Carthamus tinctorius* L.) is a multipurpose oilseed and industrial crop with great potential to be grown in arid and semi-arid regions of the world. Safflower petals are a source of carthamin and carthamidin used for medicinal purposes, natural food colourant, colouring of cosmetics and dyeing textile fabrics. Safflower is an attractive option from the synthetic colourants. Despite the many uses of safflower flowers, petal production is still at its infancy stage compared to seed production. Understanding the best time to harvest safflower petals will promote safflower production and product development hence diversify farmer incomes. Therefore, this review compiles literature on how time of harvesting petals influences petal yield, seed yield, carthamin, and carthamidin contents in safflower.

Keywords: *Carthamus tinctorius* L., natural dye, petals, plant pigments

Résumé

Le carthame (*Carthamus tinctorius* L.) est une culture oléagineuse et industrielle polyvalente qui présente un grand potentiel dans les régions arides et semi-arides du monde. Les pétales de carthame sont une source de carthamine et de carthamidine utilisées à des fins médicinales, comme colorant alimentaire naturel, pour la coloration des cosmétiques et la teinture des tissus. Le carthame est une option intéressante dans le domaine des colorants synthétiques. Malgré les nombreuses utilisations des fleurs de carthame, la production de pétales n'en est encore qu'à ses débuts, comparée à la production de graines. Comprendre le meilleur moment pour récolter les pétales de carthame permettra de promouvoir la production de carthame et le développement de produits dérivés, et donc de diversifier les revenus des agriculteurs. Par conséquent, cette revue compile la littérature sur la façon dont le moment de la récolte des pétales influence le rendement des pétales, le rendement des graines, les teneurs en carthamine et en carthamidine dans le carthame.

Mots-clés : *Carthamus tinctorius* L., colorant naturel, pétales, pigments végétaux

Introduction

Safflower (*Carthamus tinctorius* L.) is multipurpose crop primarily grown for its oilseed, rich in polyunsaturated and monounsaturated fatty acids (Sirel and Aytac, 2016). The petals of safflower are a source of red (carthamin) and yellow (carthamidin) pigments used for medicinal purposes (Adamska and Biernacka, 2021), cosmetics (Yue *et al.*, 2013) and food colourant (Machewad *et al.*, 2012). The main safflower pigment carthamin (3–6%) is red and water insoluble, while carthamidin (24–30%) is yellow and water soluble (Machewad *et al.*, 2012). Due to restrictions on the use of synthetic pigments as food colorants, eco-friendly and biodegradable dyes derived from natural resources have recently attracted a lot of attention (Singh and Nimbkar, 2006; Jadhav and Joshi, 2015). Production and demand of safflower for its petals is steadily rising in China and Europe (Singh and Nimbkar, 2006; Bagley, 2017; Vogel, 2018).

Usually, petal harvesting is done manually at the end of flowering when the colour quality is low (Omidi and Sharifmoghaddasi, 2010). Recent studies have reported that yield components and pigments content was altered, when the petals are collected at various growth stages of flower development (bud, bloom, wilting) (Mohammadi and Tavakoli 2015; Steberl *et al.*, 2020). Three petal harvesting periods (50, 75 and 100% flowering) were used by Kizil *et al.* (2008), who reported that pigment content remained unchanged. Mohammadi and Tavakoli (2015) harvested safflower petals twice: at the beginning of flowering stage and after pollination. They found that carthamidin content was high at the beginning of flowering then gradually decreased as the flower develops, while carthamin increased throughout. Therefore, knowledge of the best time of petal harvest of safflower without compromising on petal quality (carthamin and carthamidin contents) and seed yield is important. This review aims at compiling existing literature on influence of time of petal harvesting on safflower petal yield, seed yield, carthamin and carthamidin contents.

Literature Review

Petal yield. Mohammadi and Tavakoli (2015) reported that time of harvest had a significant effect on petal yield. The highest petal yield was obtained when harvested at the onset of flowering, thereafter petal yield decreased with delayed harvesting (Mohammadi and Tavakoli, 2015). Spiny safflower cultivars are reported to have low petal yield compared to the spineless (Patil *et al.*, 2005; Kizil *et al.*, 2008). On the other hand, while Steberl *et al.* (2020) reported maximum petal yield when temperatures are high during flowering period.

Seed yield. Kizil *et al.* (2008) reported that time of harvesting safflower petals did not affect seed yield. However, with regards to seed weight, Omidi and Sharifmoghaddasi (2010) reported that harvesting of petals, every three days after initiation of flowering, resulted in the highest seed weight per head, while harvesting every nine days after initiation of flowering had the least weight (Omidi and Sharifmoghaddasi, 2010).

Carthamin and Carthamidin content. Mohammadi and Tavakoli (2015) reported that percentage of carthamidin was higher when harvested at the onset of flowering than harvesting after pollination at the onset of petal wilting. On the hand the carthamin content was significantly low when petals were harvested at the onset of flowering, but increased after pollination (Kizil *et al.*, 2008). Other factors such as temperature, light, nutrition, sowing date and population have

been reported to influence the contents of carthamidin and carthamin (Steberl *et al.*, 2020).

Conclusion

Safflower petal pigments serve as valuable biochemical constituents for development of pharmaceuticals, medicinal and industrial purposes. Therefore, it is important to establish the best time to harvest petals for high pigment yield without interfering with seed yield. Further research on the influence of petal harvesting time on pigments content and yield may help to promote the expansion and product development of safflower which is still underutilized.

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