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Investigation of routine contents of buckwheat (*Fagopyrum esculentum* Moench) cultivated in Turkey

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Abstract

It was determined by the routine contents of herbs and seeds of buckwheat plant grown at Konya ecological conditions at March, April, May, June 2012, 2013 and different fertilizer doses (0, 10 and 20 kg / da DAP-18-46) for two years. Routine analyses were performed using an Agilent Technologies1200 series high pressure liquid chromatography (HPLC), including a binary pump, vacuum degasser, auto sampler, diode array detector, and coupled to an Agilent Technologies 1200 series Model VL single quadrupole mass spectrometer equipped with an multimode ionization interface. At different planting times; the amount of routine in herbs of buckwheat plant ranged from 2.15 to 2.99%, ranged from 2.27 to 2.73% at the applied fertilizer doses. Routine contents of buckwheat seeds were relatively low compared to herb plants and ranged from 0.031 to 0.071%. In this study, it was determined that the buckwheat (*Fagopyrum esculentum* Moench) grown at different planting times investigated significant differences in the routine contents of herbs and seeds.

Keywords: Buckwheat, *Fagopyrum esculentum*, Planting Time, Fertilizer, Routine, Herb, Seed

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Introduction

Buckwheat (*Fagopyrum esculentum* Moench) is a plant of the Polyganeceae family, with a single year and a short vegetative period (80-90 days) (Kan, 2014). The buckwheat is a plant based on ancient times and is of Central Asian origin. First, the buckwheat plant grown in the Hun Empire, China and Japan is grown in many countries today. Buckwheat, which is produced in many countries of the world (Russia, Ukraine, Kazakhstan, France, Czech Republic, Slovakia etc.), has been started to produce in our country in the last two years and we have two kinds of buckwheat . The buckwheat plant has fast-growing, leafy and white-pink flowers. The flowers are fragrant and suitable for nectar accumulation of honey bees (Anonymus, 2012). The buckwheat plant is benefited both from the seed (grain) and from each plant. Buckwheat grains are rich in vitamins, especially those of B group (Fabjan et al.2003). The amino acid composition of buckwheat proteins is well balanced and of a high biological value (Kato et al.2001), although the protein digestibility is relatively low (Liu et al.2001). Buckwheat grains are a rich fibre, soluble dietary fibre (SDF), and are applied in the prevention of obesity and diabetes (Brennan,2005) source of TDF (total dietary). With 80% unsaturated fatty acids more than 40% are constituted by polyunsaturated fatty acid (PUFA) (Krkošková & Mrázová2005). Buckwheat grains are an important source of microelements, such as: Zn, Cu, Mn, Se (Stibilj et al.2004), and macroelements: K, Na, Ca, Mg (Wei et al.2003).

Buckwheat plant exhibits high biological activity because it is rich in flavonoids, phenolic acids, tannins, phytosterols and phagopyrins. Six flavonoids were isolated from the buckwheat seed and the most significant amount was determined routine in total flavonoids. Rutin is one of many well-known flavonoids with a high biological activity. The routine inhibits blood platelet aggregation, increases capillary strength, and reduces their 3 permeability; additionally, it reduces the cholesterol level in the blood, has anti-oxidative and antiinflammatory effects, and contributes favourably to hepatoprotection (Chen and Hsieh, 2010).Biological activities such as neuroprotective, acetylcholinesterase, butyrylcholinesterase and antioxidant were studied according to the total phenol, flavonoid and routine contents of the extracts prepared from seeds, stems and herbs of buckwheat cultivated in Konya ecological conditions. It has been concluded that these important compounds containing buckwheat which are main compounds responsible for activity.

In this study, it was determined by the routine contents of herbs and seeds of buckwheat cultivated at five different sowing dates and different fertilizer doses in Konya ecological conditions.

Material and Method

The seeds of buckwheat were cultivated Selcuk University, Faculty of Agriculture, Medicinal Plants Research and Application Farm, (Turkey). The herbs and seeds were powdered using pestle and mortar into fine

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powder. Then the powdered samples of the seeds and herbs were submitted to successive solvent extraction sequentially with ethanol (EtOH) at room temperature for 48 h (2×500 mL). After filtration,the organic phases were evaporated by using a rotary evaporator (Buchi, Switzerland) at 40 °C to dryness in vacuo.

Routine analyses were performed using an Agilent Technologies 1200 series high pressure liquid chromatography (HPLC), including a binary pump, vacuum degasser, auto sampler, diode array detector, and coupled to an Agilent Technologies 1200 series Model VL single quadrupole mass spectrometer equipped with an multimode ionization interface. Standard solutions containing rutin (5.1–1020 g mL−1) was prepared in ethanol (70%). 10 L of injections were achieved in triplicate for each standard solution to see the reproducibility of the detector response at each concentration level. Five concentrations of routine were subjected to regression analysis to calculate calibration equation and correlation. All the calculations concerning the quantitative analysis were performed with external standardization by measurement of peak areas (Gülpınar et al, 2012)

Results and Discussion

The routine of herbs and seeds content of buckwheat grain samples is given in Table 1 and Table 2 respectively. According to the variance analyzes performed, the effect of different sowing dates and fertilizer doses on the routine rate of buckwheat herb was statistically significant at 1% level.

In this study, it was determined that to different sowing dates, the highest amount of routine obtained from all herbs of buckwheat was obtained from the application of third sowing date in 2012 (2.99%), while the lowest amount of routine (2.15%) was obtained from first sowing date applications. According to different fertilizer applications; the highest amount of routine was obtained from application of fertilizer (2.90%) at 10 kg / da and the lowest amount of routine was obtained from control plots (2.27%).

In this study, it was determined that to the variance analyzes performed, the effect of different sowing dates on the routine rate of buckwheat seeds was statistically significant at 1% level. According to this study, the highest amount of routine obtained from the seeds of the buckwheat was obtained at the second sowing date (0.07%) and the lowest at the fifth sowing date (0.03%) in the seeds when both trial years were evaluated together. It has been concluded that the different fertilizer doses applied on the routine contents of buckwheat seeds are not effective. It was determined that the buckwheat plant is much more in herbs than the routine contents. Routine quantities found in other studies were found to be lower than this study. The content of routine of buckwheat seeds and herbs were affected by different sowing dates, different production techniques and ecological factors. At the same time, the content of routine is depend on genotype, sowing dates, cultivating conditions, development period, part of plant and harvesting time. Different cultivars of buckwheat may have different contents of routine with potential variation also in different part of plants (Ahmed et. al,2013). Most of routine is accumulated in the in florescence (up to 0.12 mg/g DW), in stalks (0.004–0.01 mg/g DW),upper leaves (0.08–0.10 mg/g DW) (Hagels 1999) and 0.12–0.36 mg/g DW in grains depending on the variety and growth conditions (Kitabayashi et al.1995;Brunori et al.2010; Park et al.2011). Routine contents of dry matter in buckwheat seed were reported to ranged from 12.6-35.9 mg / 100g (Tian et al., 2002) and from 0.05 g / 100 g to 1.35 / 100 g (Bai et al., 2015). It is concluded that different fertilizer doses applied on the routine contents of buckwheat seeds are not effective. The routine contents of buckwheat were found to be much higher in herbs than in seeds. The same time, ecological factors such as cultivating conditions may also have a great influence on routine content (Kreft et al., 2002).

In this study, it was determined that the buckwheat (*Fagopyrum esculentum* Moench) cultivated at different sowing date investigated significant differences in the routine contents of herbs and seeds. The routine content of buckwheat, in other pseudo-cereals no routine compound is found.

Table 1. Routine amounts (%) obtained from buckwheat herb according to different applications

Year	Sowing Date	Fertilizer Dose (kg/da)			Average
		Control	10	20	
2012	1st sowing date (21.03.2012)	2,15r	2,16qr	2,15r	2.15h
	2nd sowing date (15.04.2012)	2,17qr	2,51klm	2,52jkl	2.40f
	3rd sowing date (07.05.2012)	2,55ıj	3,21c	3,20c	2.99a
	4th sowing date (22.05.2012)	2,20q	2,99d	2,30o	2.50e
	5th sowing date (11.06.2012)	2,25p	3,65a	2,27op	2.72b
	Average	2.27e	2.90a	2.49d	2.55a
2013	1st sowing date (26.03.2013)	2,25p	2,28op	2,34n	2.29g
	2nd sowing date (29.04.2013)	2,72ef	2,74e	3,45b	2.97a
	3rd sowing date (14.05.2013)	2,47m	2,52jkl	2,54jk	2.51e
	4th sowing date (10.06.2013)	2,55ıjk	2,59hı	2,61h	2.58d
	5th sowing date (21.06.2013)	2,49lm	2,67g	2,69fg	2.61c
	Average	2.49d	2.56c	2.73b	2.59a

Table 2. Routine amounts (%) obtained from buckwheat seeds according to different applications

Year	Sowing Date	Fertilizer Doses (kg/da)			Average
		Control	10	20	
2012	1st sowing date (21.03.2012)	0,03g	0,08a	0,07b	0.06b
	2nd sowing date (15.04.2012)	0,07b	0,07b	0,07b	0.07a
	3rd sowing date (07.05.2012)	0,06bc	0,06bc	0,06bc	0.06b
	4th sowing date (22.05.2012)	0,06bc	0,06bc	0,05c	0.06b
	5th sowing date (11.06.2012)	0,05c	0,05c	0,06bc	0.05c
	Average	0.05	0.06	0.06	0.06
2013	1st sowing date (26.03.2013)	0,07b	0,06bc	0,06bc	0.06b
	2nd sowing date (29.04.2013)	0,05c	0,06bc	0,05c	0.05c
	3rd sowing date (14.05.2013)	0,04e	0.04e	0.04e	0.04e
	4th sowing date (10.06.2013)	0,04e	0.03f	0.04e	0.04f
	5th sowing date (21.06.2013)	0,03f	0,03f	0,02g	0.03g
	Average	0.05	0.04	0.04	0.04

Conclusion

Buckwheat is not a cereal, it is actually a gluten-free seed which is a suitable for people who are sensitive to wheat or other cereal grains that contain protein glutens. Buckwheat is very good source of manganese and good source of magnesium, copper and diatery fibre. Buckwheat has more protein, phenolic compounds (especially routine) than rice, wheat, millet, corn. Buckwheat, compared to rice, wheat and corn, has low on the glycemic index. The parts of the buckwheat plant that contains the highest routine is its herb.

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