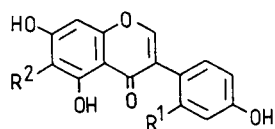


VARIATION IN OESTROGENIC ISOFLAVONE AND TOTAL ALKALOID CONTENT DURING EARLY GROWTH OF A COMMERCIAL VARIETY OF LUPINUS ALBUS

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In several countries, lupin seeds are used as a source of protein in both human and animal food. Selective breeding has reduced the alkaloid content to a non-toxic level ($<10 \text{ mg.g}^{-1}$) (Hudson *et al* 1976). Lupins also produce isoflavones (Ingham *et al* 1983), some of which exert oestrogenic effects in mammals (Price and Fenwick 1985) and we have shown that significant levels of isoflavones are present in seedlings of a sweet variety of L. albus (Pantry *et al* 1985). Further work has been carried out on another sweet variety of L. albus and we wish to report on the isoflavone and alkaloid content at various stages during the plant's growth period. L. albus cv Tifwhite-78 seeds were surface sterilized and allowed to germinate and grow in moist vermiculite at approximately 20°C in natural light. Ethanolic extracts of 50 seedlings were made at 8 times between days 0 and 42 of germination. Isoflavone constituents were monitored using an isocratic reverse-phase HPLC system, previously calibrated for genistein, 2'-hydroxygenistein and luteone. Alkaloids were also extracted at the same 8 stages of development using a standard technique involving Merck Extrelut columns. The total concentration of the three isoflavones reached its maximum 13 days after germination (Table 1) and genistein was present in the highest concentration at this stage (1.44 mg.g^{-1}). It is known that other plants containing genistein at a level as low as $20 \mu\text{g.g}^{-1}$ exert oestrogenic effects in sheep (Bradbury and White 1951). In our study, potentially toxic levels of isoflavones were present in this sweet variety of L. albus from the 4th day after germination. Although the seeds were apparently free from genistein, 2'-hydroxygenistein and luteone, they contained a considerable quantity of highly polar phenolic substances which could be oestrogenic isoflavone glycosides (Price and Fenwick 1985). There is no obvious correlation between isoflavone and alkaloid concentrations in this plant (Table 1). The total alkaloid content was at a maximum of 2.16 mg.g^{-1} in the dry seeds and never exceeded a toxic level during germination. Development of low isoflavone containing varieties should be considered if lupins are to be grown as a commercial fodder crop.



A: genistein $R^1 = R^2 = H$
 B: 2'-hydroxygenistein $R^1 = OH, R^2 = H$
 C: luteone $R^1 = OH, R^2 = CH_2CH = C(CH_3)_2$

Time (days) after surface sterilization	Stage of Development	Constituents of fresh weight in mg.g^{-1}				
		Isoflavones			TOTAL (A+B+C)	Total alkaloids
		A	B	C		
0	seeds	nd	nd	nd	-	2.16
1	imbibed seeds	nd	nd	nd	-	1.49
2	testa splits, radical emerges	nd	nd	nd	-	0.13
4	radical - 2cm cotyledons intact	nd	0.04	0.04	0.08	1.89
9	plumule emerges cotyledons fully open	nd	nd	0.30	0.30	0.83
13	first leaves root - 8cm	1.44	0.52	0.81	2.77	0.10
25	second leaves root system - 17 cm	0.47	0.16	0.38	1.01	1.25
42	stem 4 cm third set of leaves emerges	0.71	1.10	0.51	2.32	1.67

Table 1: Variation in isoflavone and alkaloid content during the early growth period of L. albus cv. Tifwhite-78 (nd = not detected)

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