

Supplementary materials

Table S1. Comparisons of free amino acid compositions of raw material and fermentation according to the harvest periods of mountain-cultivated ginseng sprouts.

Contents ¹ (mg/ 100 g)	Harvest periods							
	17-May		31-May		21-June		13-July	
	MCGS ²	FAMCGS	MCGS	FAMCGS	MCGS	FAMCGS	MCGS	FAMCGS
Non-essential amino acids								
Phosphoethanolamine	nd ³	nd	15.34 ± 0.12 ^a	nd	14.79 ± 0.14 ^b	nd	nd	nd
Proline	28.42 ± 0.02 ^a	3.55 ± 0.03 ^c	17.50 ± 0.25 ^a	2.61 ± 0.01 ^d	10.00 ± 0.10 ^b	3.21 ± 0.01 ^c	11.20 ± 0.22 ^b	2.00 ± 0.02 ^d
Hydroxyproline	0.38 ± 0.00 ^b	nd	0.42 ± 0.00 ^a	nd	nd	nd	nd	nd
Aspartic acid	81.65 ± 0.80 ^a	32.77 ± 0.21 ^c	42.33 ± 0.41 ^b	19.86 ± 0.11 ^d	39.24 ± 0.35 ^c	16.01 ± 0.12 ^d	51.04 ± 0.85 ^b	18.97 ± 0.35 ^d
Serine	49.14 ± 0.49 ^a	11.91 ± 0.11 ^c	31.16 ± 0.12 ^b	6.90 ± 0.05 ^d	25.14 ± 0.51 ^b	6.59 ± 0.05 ^d	30.91 ± 0.54 ^b	8.14 ± 0.09 ^c
Aspartic acid - NH ₂	83.85 ± 0.81 ^a	17.90 ± 0.14 ^c	32.87 ± 0.21 ^b	5.37 ± 0.06 ^d	28.73 ± 0.24 ^c	3.69 ± 0.04 ^d	45.86 ± 0.84 ^b	12.33 ± 0.25 ^c
Glutamic acid	33.63 ± 0.31 ^a	16.39 ± 0.15 ^c	25.58 ± 0.11 ^b	10.20 ± 0.15 ^c	25.53 ± 0.25 ^b	8.54 ± 0.08 ^d	33.15 ± 0.66 ^a	11.56 ± 0.32 ^c
Sarcosine	nd	nd	nd	nd	nd	nd	3.00 ± 0.00 ^a	nd
Aminoadipic acid	5.04 ± 0.01 ^a	1.54 ± 0.01 ^c	2.09 ± 0.01 ^b	nd	1.71 ± 0.01 ^c	nd	3.03 ± 0.03 ^b	0.97 ± 0.01 ^d
Glycine	10.38 ± 0.11 ^a	6.55 ± 0.06 ^b	7.33 ± 0.08 ^b	5.21 ± 0.05 ^c	5.96 ± 0.05 ^c	5.06 ± 0.05 ^d	6.96 ± 0.09 ^b	4.81 ± 0.04 ^d
Alanine	67.95 ± 0.25 ^a	10.12 ± 0.10 ^d	46.91 ± 0.45 ^b	7.02 ± 0.07 ^e	32.88 ± 0.61 ^c	9.93 ± 0.09 ^d	45.01 ± 0.90 ^b	12.80 ± 0.15 ^d
Citrulline	nd	3.51 ± 0.02 ^b	nd	5.12 ± 0.02 ^a	nd	5.36 ± 0.05 ^a	1.20 ± 0.01 ^d	2.31 ± 0.02 ^c
α-aminobutyric acid	22.91 ± 0.02 ^a	5.26 ± 0.05 ^c	8.18 ± 0.08 ^b	1.07 ± 0.01 ^d	8.07 ± 0.02 ^b	2.52 ± 0.03 ^d	6.14 ± 0.06 ^c	1.84 ± 0.15 ^d
Cystathionine	nd	nd	4.73 ± 0.04 ^a	nd	4.10 ± 0.01 ^b	nd	nd	nd
Tyrosine	23.02 ± 0.21 ^a	2.79 ± 0.12 ^d	16.34 ± 0.15 ^b	2.53 ± 0.02 ^d	8.78 ± 0.05 ^c	2.77 ± 0.02 ^d	11.53 ± 0.22 ^b	1.63 ± 0.01 ^d
β-alanine	15.72 ± 0.12 ^a	3.51 ± 0.12 ^c	6.49 ± 0.09 ^b	2.50 ± 0.01 ^d	5.43 ± 0.06 ^b	4.00 ± 0.01 ^c	5.96 ± 0.02 ^b	3.05 ± 0.03 ^d
β-aminoisobutyric acid	9.88 ± 0.08 ^a	1.06 ± 0.01 ^d	4.36 ± 0.04 ^b	0.71 ± 0.01 ^d	3.85 ± 0.03 ^b	3.24 ± 0.03 ^c	3.85 ± 0.65 ^b	0.84 ± 0.00 ^d
γ-aminobutyric acid	91.10 ± 0.08 ^a	11.91 ± 0.01 ^c	68.66 ± 0.62 ^b	7.91 ± 0.07 ^d	67.36 ± 0.81 ^b	10.22 ± 0.15 ^d	87.17 ± 1.52 ^a	12.55 ± 0.24 ^c
Aminoethanol	13.58 ± 0.12 ^a	1.54 ± 0.02 ^c	9.61 ± 0.08 ^b	1.23 ± 0.01 ^c	7.11 ± 0.02 ^b	1.10 ± 0.00 ^c	8.02 ± 0.08 ^b	1.38 ± 0.01 ^c
Hydroxylysine	1.74 ± 0.01 ^a	1.28 ± 0.05 ^c	1.63 ± 0.01 ^a	1.18 ± 0.01 ^d	1.57 ± 0.01 ^b	1.19 ± 0.00 ^d	1.48 ± 0.01 ^b	1.20 ± 0.01 ^c
Ornithine	11.11 ± 0.12 ^a	2.47 ± 0.01 ^c	9.83 ± 0.08 ^a	1.88 ± 0.00 ^d	7.70 ± 0.07 ^b	1.74 ± 0.01 ^d	7.51 ± 0.08 ^b	1.98 ± 0.01 ^d
Arginine	170.94 ± 1.21 ^b	25.96 ± 0.25 ^d	149.32 ± 5.12 ^c	12.13 ± 0.12 ^e	157.72 ± 4.16 ^c	11.92 ± 0.25 ^e	200.59 ± 4.01 ^a	32.01 ± 0.31 ^d
Total	720.44	160.02	500.68	93.43	455.67	97.09	563.61	130.37
Essential amino acids								
Threonine	36.21 ± 0.32 ^a	7.90 ± 0.01 ^c	20.85 ± 0.12 ^b	4.33 ± 0.04 ^d	20.20 ± 0.51 ^b	4.57 ± 0.01 ^d	24.38 ± 0.50 ^b	4.62 ± 0.01 ^d
Valine	61.38 ± 0.62 ^a	17.55 ± 0.15 ^c	35.81 ± 0.81 ^b	9.18 ± 0.08 ^d	32.05 ± 0.62 ^b	10.09 ± 0.30 ^d	34.13 ± 0.75 ^b	9.79 ± 0.09 ^d
Methionine	16.35 ± 0.14 ^a	nd	4.03 ± 0.01 ^c	nd	3.55 ± 0.01 ^d	nd	4.16 ± 0.01 ^b	nd
Isoleucine	41.55 ± 0.41 ^a	17.62 ± 0.14 ^c	22.63 ± 0.45 ^b	10.73 ± 0.15 ^d	21.41 ± 0.45 ^b	10.35 ± 0.24 ^d	26.80 ± 0.62 ^b	11.67 ± 0.21 ^d
Leucine	51.18 ± 0.11 ^a	7.87 ± 0.08 ^d	30.57 ± 0.61 ^b	7.13 ± 0.07 ^d	27.31 ± 0.56 ^c	7.18 ± 0.00 ^d	33.33 ± 0.76 ^b	7.25 ± 0.07 ^d
Phenylalanine	43.39 ± 0.45 ^a	5.93 ± 0.05 ^c	21.81 ± 0.21 ^b	5.17 ± 0.05 ^d	20.11 ± 0.45 ^b	5.37 ± 0.02 ^d	24.58 ± 0.52 ^b	5.26 ± 0.56 ^d
Lysine	40.79 ± 0.25 ^a	2.39 ± 0.02 ^d	28.77 ± 0.51 ^b	nd	20.78 ± 0.64 ^c	1.57 ± 0.00 ^d	24.00 ± 0.49 ^b	2.05 ± 0.02 ^d

Histidine	16.41 ± 0.15 ^a	1.06 ± 0.14 ^d	11.65 ± 0.21 ^b	0.90 ± 0.00 ^d	8.74 ± 0.21 ^c	0.79 ± 0.00 ^d	12.67 ± 0.25 ^b	0.99 ± 0.99 ^d
Total	307.26	60.32	176.12	37.44	154.15	39.92	184.05	41.63
Total amino acids	1027.70	220.34	676.80	130.87	609.82	137.01	747.66	172.00
Ammonia	22.48 ± 0.25 ^a	15.37 ± 0.14 ^b	14.88 ± 0.21 ^b	12.10 ± 0.24 ^c	14.16 ± 0.28 ^b	11.94 ± 0.21 ^c	15.83 ± 0.32 ^b	9.89 ± 0.01 ^d

¹Data are expressed as the mean ± SD, and differences were analyzed using Tukey's test, $n = 3$. The results without common superscript letters (a to e) within the same row were statistically different ($p < 0.05$).

²Abbreviation: MCGS, mountain-cultivated ginseng sprouts and FAMCGS, fermented aging mountain-cultivated ginseng sprouts.

³nd: not detected.

Table S2. Comparisons of mineral compositions of raw material and fermentation according to the harvest periods of mountain-cultivated ginseng sprouts.

Contents ¹ (mg/ 100 g)	Harvest periods							
	17-May		31-May		21-June		13-July	
	MCGS ²	FAMCGS	MCGS	FAMCGS	MCGS	FAMCGS	MCGS	FAMCGS
Phosphorus (P)	2.17 ± 0.03 ^a	2.29 ± 0.04 ^a	1.99 ± 0.02 ^b	1.73 ± 0.02 ^c	1.59 ± 0.02 ^d	1.74 ± 0.03 ^c	1.46 ± 0.02 ^d	1.72 ± 0.03 ^c
Sulfur (S)	2.65 ± 0.05 ^a	2.97 ± 0.05 ^a	2.29 ± 0.03 ^d	2.34 ± 0.04 ^c	2.36 ± 0.03 ^c	2.54 ± 0.05 ^b	2.16 ± 0.04 ^d	2.43 ± 0.06 ^b
Kalium (K)	14.89 ± 0.14 ^a	12.45 ± 0.12 ^b	11.62 ± 0.12 ^b	7.44 ± 0.07 ^d	15.11 ± 0.15 ^a	9.92 ± 0.09 ^c	9.47 ± 0.10 ^c	9.16 ± 0.11 ^c
Calcium (Ca)	6.69 ± 0.06 ^d	7.59 ± 0.07 ^b	6.83 ± 0.05 ^d	7.40 ± 0.09 ^b	7.01 ± 0.07 ^c	7.91 ± 0.07 ^a	6.75 ± 0.09 ^d	7.29 ± 0.08 ^b
Magnesium (Mg)	2.15 ± 0.03 ^a	2.23 ± 0.05 ^a	2.13 ± 0.03 ^a	1.93 ± 0.02 ^c	1.82 ± 0.01 ^d	1.84 ± 0.12 ^d	1.97 ± 0.03 ^b	1.92 ± 0.02 ^c
Iron (Fe)	0.71 ± 0.01 ^a	0.75 ± 0.02 ^a	0.57 ± 0.01 ^b	0.78 ± 0.01 ^a	0.35 ± 0.01 ^d	0.46 ± 0.01 ^c	0.44 ± 0.02 ^c	0.49 ± 0.02 ^b
Zinc (Zn)	0.02 ± 0.00 ^a	0.02 ± 0.00 ^a	0.02 ± 0.00 ^a	0.02 ± 0.00 ^a	0.02 ± 0.00 ^a	0.02 ± 0.00 ^a	0.01 ± 0.00 ^b	0.02 ± 0.00 ^a
Manganese (Mn)	0.06 ± 0.00 ^a	0.06 ± 0.00 ^a	0.04 ± 0.00 ^b	0.04 ± 0.00 ^b	0.03 ± 0.00 ^c	0.04 ± 0.00 ^b	0.03 ± 0.00 ^c	0.04 ± 0.00 ^b
Titanium (Ti)	0.06 ± 0.00 ^a	0.06 ± 0.00 ^a	0.05 ± 0.00 ^b	0.06 ± 0.00 ^a	0.03 ± 0.00 ^d	0.04 ± 0.00 ^c	0.04 ± 0.00 ^c	0.04 ± 0.00 ^c
Sodium (Na)	0.49 ± 0.01 ^c	0.71 ± 0.01 ^b	0.26 ± 0.01 ^d	0.81 ± 0.00 ^a	0.35 ± 0.01 ^c	0.87 ± 0.02 ^a	0.14 ± 0.01 ^d	0.68 ± 0.01 ^b
Aluminum (Al)	1.03 ± 0.03 ^b	1.90 ± 0.03 ^a	0.82 ± 0.02 ^b	1.07 ± 0.01 ^b	0.48 ± 0.02 ^d	0.64 ± 0.01 ^c	0.66 ± 0.02 ^c	0.69 ± 0.01 ^c
Total	30.92	31.03	26.62	23.62	29.15	26.02	23.13	24.48

¹ Data are expressed as the mean ± SD, and differences were analyzed using Tukey's test, $n = 3$. The results without common superscript letters (a to d) within the same row were statistically different ($p < 0.05$).

² Abbreviation: MCGS, mountain-cultivated ginseng sprouts and FAMCGS, fermented aging mountain-cultivated ginseng sprouts.

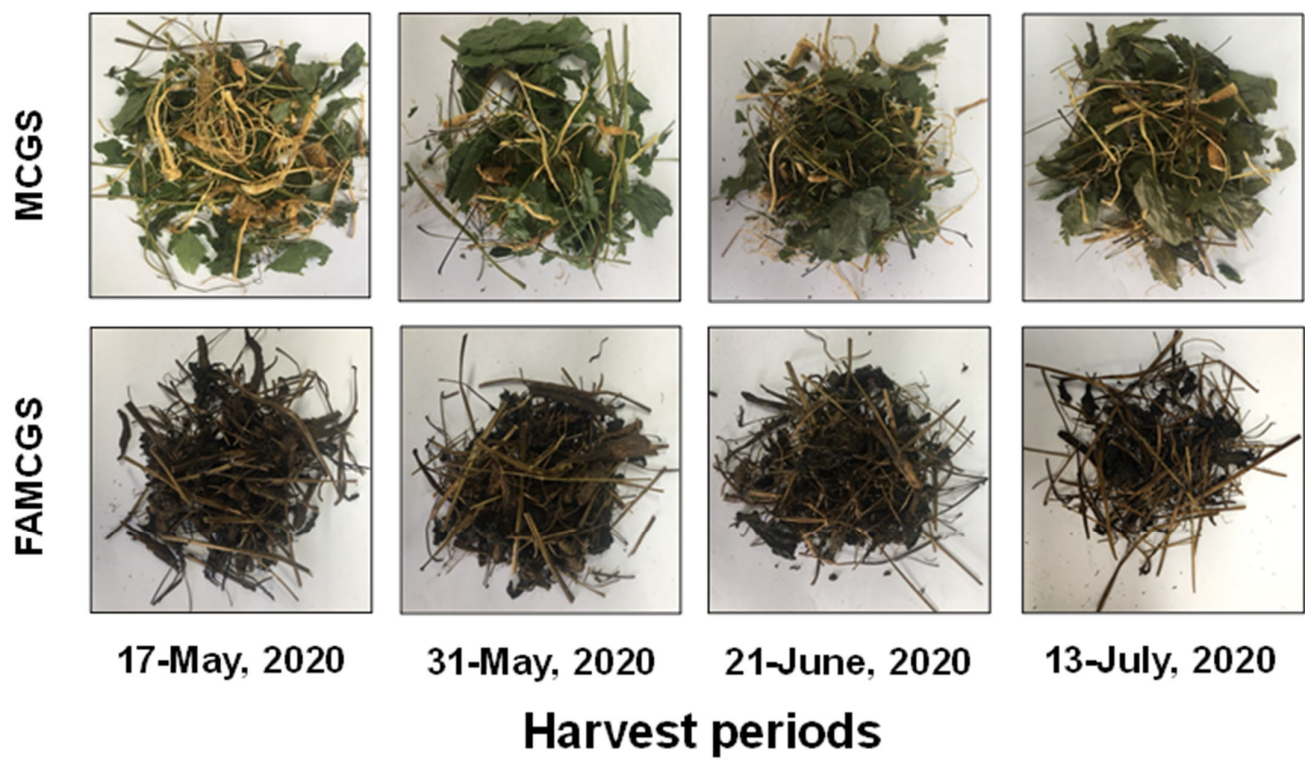


Figure S1. Photograph of raw material and fermentation according to the harvest periods of mountain-cultivated ginseng sprouts.