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Research Article

CHARACTERIZATION OF SEED LIPID COMPOSITION IN SOME CROPS GROWN IN ESKISEHIR PROVINCE IN TURKIYE

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ABSTRACT. In this study, wheat, barley and oat lipids were examined comparatively with safflower oil and their quality values were revealed. **Bread Wheat Genotypes;** Bezostaja, Yunus, Altay, Müfitbey and Nacibey; **Barley Genotypes;** 4193, İnce, 5252, Özdemir and Ünver; **Oat Genotypes;** Checota, Seydişehir, Yeniçeri, Kırıklar and Kahraman; **Safflower Genotypes;** Yenice, Dinçer, Balcı, Linas and Olas were used. Seed lipid composition in bread wheat, barley, oat and safflower genotypes were determined. In bread wheat; the numbers of genotypes with the highest values in terms of components were similar. In barley; İnce and Ünver genotypes had the highest values in more components than other barley genotypes. In oats; Checota and Kırıklar genotypes, as the genotypes with the highest values, have a clear difference compared to other oat genotypes. In safflower; Except for Yenice and Linas; Dinçer, Balcı and Olas genotypes had the highest values in more components. In bread wheat, barley, oats and safflower; for all genotypes, asparagine, glycine, APX, vitamin B_2, vitamin B_6 were determined to be more effective than other components in the production of quality seed lipid. Barley and oat genotypes showed superior performance compared to wheat and safflower genotypes. This shows that barley and oats are of high quality and rich in chemical content. Özdemir and Ünver genotypes were determined as superior performing and stable genotypes.

Keywords: Bread wheat, barley, oat, safflower genotype, minerals, amino acids, lipids, enzymes, vitamins, hierarchical cluster, biplot.

INTRODUCTION

Cereals constitute the most important food source in the world. Especially wheat (*Triticum aestivum* L.), barley (*Hordeum vulgare* L.) and oat (*Avena sativa* L.) are important product groups

for human nutrition, animal husbandry and industrial purposes. In particular, wheat constitutes an important input in meeting people's energy needs, both in the form of bread and other bakery products. Wheat alone provides more than fifty percent of the daily calorie needs. Barley shows itself as an important crop in human nutrition in the malt industry, animal husbandry and recently flour. It is an indispensable product for the malt industry, including brewing, and animal husbandry. Although oats have been an important input for livestock farming for many years, they are not as widely used as barley and wheat [1-2]. However, in recent years, it has become increasingly important in human nutrition as well as in animal husbandry due to the richness of the nutritional components it contains. Avenin is energizing for animals and is preferred in baby foods because it encourages rapid growth in babies. Again, hordein, found in barley, has properties similar to avenin, and its use in human nutrition is increasing. In addition, since barley and oats do not contain gluten, they are an important alternative in bread production for celiac patients [2-3-4]. Due to these characteristics, wheat, barley and oats will increase their importance in the future, as they do today. On the other hand, the use of seeds, as well as forage plants, is increasing in order to increase meat and dairy products, which have an important place in human nutrition. Therefore, wheat, barley and oats are of great importance [3-4]. Nutritional quality of wheat, barley and oats; the amino acids, organic acids, enzymes, secondary metabolites and minerals they contain have an important place. These substances are located both in the bran, in the endosperm, and on the lipid in the embryo. Therefore, the amount of lipid contained in seeds has an important place in terms of the nutrition and quality of the plant. It has been demonstrated by many researchers that approximately half of these substances are dissolved in seed lipid [5-6-7]. Therefore, the quality of the lipid is as important as the amount of lipid contained in the seeds of wheat, barley and oats. Just as the plant uses this lipid in the biochemical events required for its growth, it also stores it in the seed to create quality seeds for future generations. Minerals, amino acids, organic acids, secondary metabolites, enzymes found in wheat lipid are consumed to be used in biochemical events, especially in photosynthesis of the plant [8-9-10]. Therefore, in order to carry out these events, the plant quickly absorbs and uses these substances in wheat lipid. On the other hand, wheat, barley and oat lipid are important lipids sought after due to their rich components, especially in alternative medicine and the cosmetic industry. Due to these contents, wheat, barley and oat lipid have anti-aging, cell regenerating and endurance enhancing effects on humans. These substances, found in plant seeds and lipids, also play an important role in the plant's resistance to biotic and abiotic stresses. In particular, amino acids, minerals and other metabolites that increase the plant's defences and strengthen its defence mechanism, contribute significantly to the plant's safe entry into the senescence period by tightening the cell wall of the plant, strengthening the outer wall, reducing injuries, stopping the development of the plant and creating and accelerating defence

mechanisms [8-9]. Due to these properties, revealing the chemical composition of wheat, barley and oat lipids will provide an important basis for understanding this issue and further research in this field.

Safflower (*Carthamus tinctorius* L.) plant, as a lipid plant, is increasingly gaining importance in meeting people's lipid needs, both with the rich chemical composition of its lipid and the high amount of unsaturated fatty acids in its lipid. In addition, it is a sought-after plant in rotation due to its suitability for the rotation system in dry farming. Due to these properties, safflower lipid was examined in comparison with wheat, barley and oat lipid for this study. In this study, wheat, barley and oat lipids were examined comparatively with safflower lipid and their quality values were revealed.

MATERIALS AND METHODS

Study was carried out in laboratories of Eskisehir Osmangazi University, Faculty of Agriculture in 2022. In the study, Bread Wheat Genotypes; Bezostaja, Yunus, Altay, Müfitbey and Nacibey; Barley Genotypes; 4193, İnce, 5252, Özdemir and Ünver; Oat Genotypes; Checota, Seydişehir, Yeniçeri, Kırıklar and Kahraman; Safflower Genotypes; Yenice, Dinçer, Balcı, Linas and Olas were used. Seed lipid composition in bread wheat, barley, oat and safflower genotypes were determined. Seed lipid content in all genotypes were extracted by Soxhlet Apparatus using a with petroleum ether for 5 h. The ether solvent in a rotary vacuum evaporator at 50 °C, reckoned as % was removed [11]. Amino acid analysis [12-13]; mineral analysis [14-15-16]; vitamin A analysis [17]; Vitamin C analysis [18-19]; vitamin B1 vitamin B2 vitamin B6 analysis [20-21]; lipid acids analysis [22]; enzymes analysis [23-24-25] were made.

RESULTS AND DISCUSSION

Cereals are the plants with the highest cultivation area and production amount due to their genetic capacity, carbohydrate source and wide adaptability. Cereals are widely used in both human nutrition and animal nutrition. Cereals are used as flour in the production of bread, flour and bakery products, as industrial raw materials, as seed lipid in the cosmetic industry and alternative medicine, and in animal husbandry. Safflower, a lipid plant, is also used as raw material in the lipid industry and home consumption. Fatty acids, amino acids, enzymes and mineral contents of wheat, oat and safflower seeds are given in Table 1 and Table 2.

Table 1. Fatty acids, amino acids, enzymes and mineral contents of wheat, oat and safflower seeds.

Table 1. Fatty acids, amino acids, enzymes and mineral contents of wheat, oat and safflower seeds.

		% Lipid Content	µg/µl Caprotic	Lauroleic	Myristoleic	Palmitoleic	Oleic	Linoleneic	Linoleic	Erusic	Butyric	Caprylic	Lauric	Myristic	Palmitic	Stearic	Linoetic	Linolenic
Bread Wheat (*T.aestivum L.*)	Bezostaya	1,97	1,65	2,07	0,93	1,29	39,78	32,56	133,88	0,69	0,08	0,47	0,04	0,44	0,45	0,45		4,11
	Yunus	1,29	1,74	1,98	1,02	1,14	42,45	31,3	132,62	0,61	0,06	0,38	0,03	0,39	0,41	0,32		4,21
	Altay	1,41	1,47	1,87	1,24	1,17	44,63	35,54	120,53	0,53	0,11	0,56	0,01	0,34	0,48	0,39		3,39
	Müfitbey	1,15	1,80	2,22	1,05	1,02	38,33	33,2	125,76	0,68	0,05	0,51	0,03	0,19	0,42	0,42		3,79
	Nacibey	1,38	1,56	1,84	1,11	1,05	40,51	32,77	126,76	0,56	0,05	0,45	0,01	0,29	0,51	0,33		3,87
	Mean	1,44	1,65	1,99	1,07	1,13	41,14	33,11	127,91	0,61	0,07	0,47	0,02	0,33	0,46	0,39		3,86
	ö	0,28	0,12	0,14	0,10	0,10	2,19	1,34	4,86	0,06	0,02	0,06	0,01	0,08	0,04	0,05		0,29
Oat (*A.sativa L.*)	Checota	4,03	1,84	2,24	1,04	1,43	44,67	36,86	152,89	0,76	0,09	0,52	0,03	0,49	0,50	0,51		4,25
	Seydisehir	5,42	1,94	2,14	1,14	1,26	47,67	35,65	151,45	0,68	0,07	0,43	0,02	0,44	0,47	0,36		3,42
	Yeniçeri	5,73	1,64	2,02	1,43	1,30	50,12	40,23	137,65	0,59	0,12	0,63	0,01	0,38	0,53	0,44		3,82
	Kırıklar	4,61	2,00	2,39	1,18	1,13	43,04	37,58	143,62	0,75	0,05	0,57	0,02	0,22	0,47	0,47		3,90
	Kahramanı	4,17	1,74	1,98	1,24	1,16	45,49	37,10	144,76	0,63	0,04	0,51	0,02	0,33	0,57	0,37		3,90
	Mean	4,79	1,83	2,15	1,21	1,26	46,20	37,49	146,07	0,68	0,08	0,53	0,01	0,37	0,51	0,43		4,17
	ö	0,67	0,13	0,15	0,13	0,11	2,46	1,51	5,55	0,07	0,03	0,07	0,01	0,09	0,04	0,05		0,26
Barley (*H.vulgare L.*)	4193	1,47	1,57	1,84	0,92	1,03	37,8	27,82	116,13	0,55	0,06	0,34	0,01	0,35	0,38	0,29		3,75
	Ince	1,36	1,32	1,73	1,07	1,05	39,74	31,40	105,54	0,48	0,10	0,50	0,02	0,3	0,43	0,35		3,83
	5252	1,39	1,62	2,05	0,95	0,92	34,13	29,33	110,13	0,61	0,03	0,45	0,02	0,17	0,37	0,38		4,11
	Ördemir	1,33	1,40	1,70	1,00	0,95	36,07	28,95	111,00	0,51	0,04	0,40	0,02	0,26	0,46	0,30		3,77
	Cuver	1,46	1,65	2,07	0,93	1,29	39,78	32,56	133,88	0,68	0,08	0,47	0,03	0,44	0,45	0,45		3,75
	Mean	1,39	1,48	1,83	3,48	0,99	36,94	29,38	110,70	0,54	0,06	0,42	0,01	0,27	0,41	0,33		3,83
	ö	0,05	0,13	0,16	4,05	0,13	2,18	1,72	9,86	0,07	0,02	0,06	0,01	0,09	0,03	0,06		0,14
Safflower (*Carthamus L.*)	Yenice	25,80	1,62	2,05	0,95	0,92	34,13	29,33	110,13	0,61	0,04	0,45	0,01	0,17	0,38	0,38		4,21
	Dincer	29,30	1,40	1,70	1,00	0,95	36,07	28,95	111,00	0,51	0,04	0,40	0,01	0,26	0,46	0,30		3,39
	Balcı	37,00	1,65	2,07	0,93	1,29	39,78	32,56	133,88	0,68	0,08	0,47	0,02	0,44	0,45	0,45		3,85
	Linas	36,40	1,74	1,98	1,02	1,14	42,45	31,50	132,62	0,61	0,06	0,38	0,01	0,39	0,42	0,33		4,11
	Olas	37,30	1,47	1,87	1,28	1,17	44,63	35,54	120,53	0,53	0,11	0,56	0,01	0,34	0,48	0,39		4,21
	Mean	33,16	1,58	1,93	1,04	1,09	39,41	31,58	121,63	0,59	0,07	0,45	0,01	0,32	0,44	0,37		3,39
	ö	4,72	0,12	0,14	0,13	0,14	3,89	2,39	10,17	0,06	0,03	0,06	0,01	0,09	0,04	0,05		0,31

		EU grplant						mg/kg					
		CAT	POD	SOD	APX	Vit A	Vit B$_1$	Vit B$_2$	Vit B$_3$	Vit C
Bread Wheat (*T.aestivum L.*)	Bezostaya	1,93	4,54	3,68	1,76	16,14	18,12	39,52	34,17	3,08
	Yunus	2,17	4,50	3,71	1,83	17,56	18,53	38,30	34,03	2,97
	Altay	2,35	4,57	3,57	1,80	18,40	19,01	39,64	29,44	2,93
	Müfitbey	2,08	6,02	2,49	2,22	15,34	17,36	46,22	25,07	2,71
	Nacibey	1,92	5,78	2,65	2,29	14,42	18,44	44,37	27,07	2,59
	Mean	2,09	5,08	3,22	1,98	16,37	18,33	41,61	29,96	2,85
	ö	0,16	0,67	0,53	0,22	1,45	0,48	3,10	3,66	0,18
Oat (*A.sativa L.*)	Checota	1,60	5,95	2,49	2,19	15,33	19,95	42,39	29,46	2,30
	Seydisehir	1,92	6,23	2,44	2,30	14,79	17,90	48,91	23,30	2,58
	Yeniçeri	1,57	6,73	2,52	2,44	16,00	15,93	51,36	22,37	2,42
	Kırıklar	1,67	7,07	2,41	2,64	16,48	14,97	49,30	23,78	2,62
	Kahramanı	1,59	6,40	2,83	2,36	14,78	17,84	47,85	23,96	2,67
	Mean	1,67	6,48	2,54	2,39	15,47	17,32	47,96	24,53	2,52
	ö	0,13	0,39	0,15	0,15	0,67	1,73	3,01	2,50	0,14
Barley (*H.vulgare L.*)	4193	1,84	6,59	2,66	2,27	15,71	19,30	45,72	26,08	2,37
	Ince	1,37	6,31	2,83	2,34	14,77	20,27	43,89	28,16	2,27
	5252	1,86	6,33	2,62	2,40	14,50	18,23	47,41	23,93	2,66
	Ördemir	1,70	6,84	2,70	2,55	15,68	16,23	49,78	22,97	2,50
	Cuver	2,17	7,18	2,59	2,76	16,16	15,25	47,79	24,42	2,71
	Mean	1,69	6,52	2,70	2,39	15,16	18,51	46,70	25,29	2,45
	ö	0,26	0,32	0,08	0,17	0,63	1,87	1,99	1,83	0,17
Safflower (*Carthamus L.*)	Yenice	2,39	4,44	3,50	1,89	16,12	17,02	33,30	21,22	3,19
	Dincer	2,00	4,46	3,60	1,83	17,36	19,02	35,90	31,67	3,07
	Balcı	2,29	4,45	3,65	1,79	17,71	19,46	34,85	32,53	3,16
	Linas	1,81	4,38	3,67	1,77	18,22	19,62	35,49	31,96	3,10
	Olas	1,77	4,59	3,64	1,90	17,13	17,87	38,71	34,25	3,04
	Mean	2,05	4,46	3,61	1,84	17,31	18,60	35,65	30,32	3,11
	ö	0,25	0,07	0,06	0,05	0,70	1,01	1,77	4,64	0,05

Table 2. Fatty acids, amino acids, enzymes and mineral contents of wheat, oat and safflower seeds.

		Aspartate	Glutamate	Asparagine	Serine	Glutamine	Histidine	Glycine	Thionine	Arginine	Alanine	Tyrosine	Cysteine	pmol/µl Valine	Methionine	Tryptophane	Phenylalanine	Isoleucine	Leucine	Lysine	Hydroxy proline	Sarcosine	Proline
Bread Wheat (*T.aestivum* L.)	Bezostaya	3319,16	1119,75	10874,41	1295,88	11673,34	390,10	505,16	569,27	1412,21	6089,33	580,09	635,35	704,59	1360,48	1827,37	1344,17	1122,27	1342,80	2390,81	1107,57	4762,87	76,26
	Yunus	3485,12	1074,96	10758,75	1334,76	11009,46	374,49	536,98	615,95	1349,22	6627,02	609,10	607,84	760,96	1401,29	1717,73	1290,40	1192,98	1452,91	2284,18	1205,37	5001,01	73,20
	Altay	3345,72	1142,69	12034,43	1254,67	11721,87	359,51	579,94	588,48	1468,36	5898,04	584,73	648,37	783,79	1317,21	1803,61	1238,79	1288,41	1388,11	2485,87	1072,78	4800,97	77,82
	Müfitbey	3164,90	1052,72	10084,75	1316,43	12235,41	394,93	466,75	575,92	1403,59	6028,96	591,14	622,18	687,96	1256,17	1728,76	1370,48	1203,35	1422,10	2247,81	1166,59	4728,12	79,68
	Nacibey	3038,30	1119,04	10184,48	1237,44	12945,38	379,14	504,09	550,23	1527,53	5365,77	567,49	661,38	708,60	1180,80	1815,20	1315,66	1299,62	1358,67	2446,29	1038,27	4539,00	84,70
	Mean	3270,64	1101,83	10787,36	1287,84	11917,09	379,63	518,59	579,97	1432,18	6001,82	586,51	635,44	729,18	1303,19	1778,54	1311,90	1221,33	1392,92	2370,99	1118,11	4766,39	78,33
	δ	154,37	32,92	695,80	36,67	644,97	12,45	37,89	21,83	60,82	403,63	13,69	18,25	36,66	77,84	45,90	45,38	65,68	40,39	91,62	60,84	147,94	3,83
Oat (*A.sativa* L.)	Checota	3129,45	1051,90	9912,32	1315,40	13753,26	362,23	548,61	489,71	1603,90	5151,14	584,52	621,70	680,25	1255,19	1964,05	1256,98	1414,37	1209,22	2568,60	996,74	4675,17	79,62
	Seydişehir	3278,61	1031,02	10384,64	1268,69	12337,92	417,92	433,94	548,10	1364,28	6290,03	600,23	642,25	536,76	1088,08	1553,82	1166,37	1381,86	1319,47	2299,20	1104,96	4811,03	81,40
	Yeniçeri	3540,90	1061,95	11038,87	1372,72	10980,75	438,81	416,59	515,21	1309,71	6805,81	648,25	661,52	570,58	1177,30	1382,90	1224,69	1326,59	1240,30	2207,23	1195,57	5195,92	83,84
	Kırıklar	3717,94	1019,47	11921,98	1413,90	10321,90	421,26	442,83	557,46	1251,29	7406,77	680,66	635,06	616,22	1212,62	1299,93	1175,70	1410,16	1342,01	2108,79	1301,14	5455,71	80,48
	Kahraman	3365,29	1193,81	10685,25	1268,07	12296,79	408,84	446,19	567,30	1376,22	6367,65	613,87	692,43	525,42	1157,12	1615,85	1241,04	1336,34	1340,13	2326,01	953,06	4773,13	82,25
	Mean	3406,44	1071,63	10788,61	1327,76	11938,13	409,81	457,63	535,56	1381,08	6404,28	625,51	650,59	585,85	1178,06	1563,31	1212,96	1373,87	1290,23	2301,97	1110,30	4982,19	81,52
	δ	204,88	62,90	676,60	57,70	1192,64	25,70	46,63	28,85	119,91	741,75	34,68	24,56	56,80	56,00	230,37	35,84	36,51	54,92	153,61	127,55	295,69	1,46
Barley (*H.vulgare* L.)	4193	3466,24	1122,18	10257,84	1347,95	13305,13	390,61	485,59	504,90	1445,03	6112,94	632,29	650,88	504,40	1230,02	1748,35	1185,69	1454,34	1192,72	2442,31	914,94	4916,33	77,32
	İnce	3327,60	1192,88	10565,57	1267,08	13970,39	374,99	524,44	482,38	1572,63	5440,52	607,00	691,89	519,54	1156,21	1835,76	1138,27	1570,69	1139,52	2657,97	814,30	4719,67	82,19
	5252	3331,09	1106,99	10856,05	1243,78	12570,16	405,06	445,59	566,24	1349,61	6455,46	593,08	686,16	513,32	1110,59	1665,94	1210,46	1369,06	1252,17	2415,39	1032,92	4818,14	78,83
	Özdemir	3597,58	1140,20	11539,98	1345,77	11187,45	425,32	427,76	532,27	1295,63	6984,80	640,53	706,74	545,66	1201,66	1482,69	1270,99	1314,30	1177,04	2318,77	1117,62	5203,59	81,19
	Ünver	3777,46	1094,59	12463,18	1386,14	10516,20	408,31	454,71	575,92	1237,84	7601,56	672,56	678,47	589,32	1237,71	1393,73	1220,15	1397,10	1273,55	2215,35	1216,31	5463,77	77,94
	Mean	3430,63	1140,56	10804,86	1301,14	12758,28	398,99	470,84	521,45	1415,73	6248,43	618,23	683,92	520,73	1174,62	1683,19	1201,35	1427,10	1190,36	2458,61	969,94	4914,43	79,88
	δ	170,82	34,33	787,34	53,69	1287,84	17,00	34,03	35,49	117,97	737,69	27,62	18,46	30,68	47,80	164,35	43,45	87,38	49,24	147,49	142,53	272,85	1,88
Safflower (*C.tinctorius* L.)	Yenice	3420,38	1125,78	10766,79	1385,91	13551,18	369,81	504,18	499,65	1450,11	6654,84	588,13	833,65	598,03	1159,82	1635,63	1336,54	1438,86	1341,58	2421,98	968,27	5012,29	76,26
	Dinçer	3591,4	1080,75	11628,14	1427,48	12738,11	355,02	535,95	540,62	1385,44	7242,47	617,53	800,30	645,87	1194,61	1537,49	1283,08	1529,51	1451,39	2313,96	1053,77	5262,91	73,20
	Balcı	3258,73	1046,98	9721,94	1324,32	12047,62	379,81	485,35	576,22	1429,29	5997,60	565,15	614,66	680,4	1301,19	1774,09	1374,04	1189,84	1494,74	2315,58	1136,21	4726,55	77,82
	Linas	3128,38	1112,94	10013,59	1244,86	12650	364,62	524,18	550,52	1555,50	5337,86	542,55	653,38	700,81	1223,12	1862,80	1319,08	1285,02	1428,07	2520,05	1011,23	4537,48	79,68
	Olas	3378,65	1146,32	10644,45	1346,94	11258,5	382,85	503,21	517,49	1493,28	5775,57	585,95	672,98	744,96	1323,42	1657,89	1385,03	1233,62	1342,39	2419,25	1094,15	4900,48	84,70
	Mean	3349,72	1091,61	10532,62	1345,64	12746,73	367,32	512,42	541,76	1455,09	6308,19	578,34	725,50	656,28	1219,69	1702,50	1328,18	1360,81	1429	2392,89	1042,37	4884,81	78,33
	δ	142,23	32,22	604,43	56,17	706,05	9,33	16,14	24,25	52,98	614,74	22,86	78,61	45,86	57,50	103,42	34,12	117,62	55,86	70,48	54,21	225,5	3,83

		% N	Na	K	Ca	mg/kg Mg	P	Fe	Cu	Mn	Zn
Bread Wheat (*T.aestivum* L.)	Bezostaya	0,81	182,82	7481,64	5168,78	2198,71	6034,52	188,48	18,86	37,09	32,95
	Yunus	0,80	180,01	7733,30	5089,39	2380,44	5821,56	193,34	16,70	38,05	30,08
	Altay	0,85	210,16	7681,94	5539,09	2317,74	5728,54	186,59	23,29	41,58	27,54
	Müfitbey	0,87	214,57	7355,71	5460,20	2222,23	5912,79	168,67	25,37	38,53	26,53
	Nacibey	0,85	211,28	7603,13	5376,33	2405,91	6302,05	173,03	22,47	39,53	31,46
	Mean	0,84	199,77	7571,14	5326,76	2305,01	5959,89	182,02	21,34	38,95	29,71
	δ	0,02	15,08	137,12	171,26	82,68	198,75	9,48	3,13	1,53	2,39
Oat (*A.sativa* L.)	Checota	0,83	208,03	7858,88	5293,75	2604,76	6079,65	177,49	19,91	40,55	28,71
	Seydişehir	0,82	191,28	7883,13	5268,15	2393,42	5728,54	174,73	19,64	40,52	27,86
	Yeniçeri	0,85	190,15	7916,97	5373,11	2289,36	6116,97	183,33	18,34	42,65	28,46
	Kırıklar	0,87	192,30	8111,34	5386,93	2107,38	6316,30	177,21	20,59	40,57	29,05
	Kahraman	0,85	189,35	8001,79	5304,18	2281,56	6093,40	181,78	18,24	41,62	26,52
	Mean	0,84	194,22	7954,42	5325,22	2335,30	6066,97	178,91	19,34	41,18	28,12
	δ	0,01	6,98	92,18	46,46	163,05	189,77	3,17	0,92	0,84	0,89
Barley (*H.vulgare* L.)	4193	0,94	614,26	8588,22	5404,62	2203,35	6332,77	177,47	19,19	32,90	23,71
	İnce	0,92	612,75	8052,03	5321,61	2385,46	6283,95	182,05	17,77	33,75	25,17
	5252	1,70	637,17	12588,37	9241,69	4263,83	10111,76	347,61	30,54	62,33	47,03
	Özdemir	1,63	746,75	11855,70	8540,36	3871,11	10737,73	381,46	28,10	58,01	51,45
	Ünver	1,59	756,49	11309,05	8243,70	3859,89	10834,03	347,26	26,75	52,62	46,33
	Mean	1,30	452,73	10271,08	7127,07	3180,94	8366,55	272,15	23,90	46,75	36,84
	δ	0,35	248,49	1816,53	1654,87	849,26	2098,22	88,59	5,06	12,31	11,82
Safflower (*C.tinctorius* L.)	Yenice	0,90	187,42	7557,14	4706,88	2883,45	5668,78	225,51	14,16	36,13	22,81
	Dinçer	0,93	192,30	7765,75	4724,55	2787,58	6186,49	227,78	15,31	37,01	27,46
	Balcı	0,90	189,35	8026,97	4651,98	3017,98	5968,17	233,66	13,56	37,97	25,06
	Linas	0,83	182,26	7309,17	5321,61	2482,34	5876,14	190,23	17,93	35,29	32,59
	Olas	0,81	179,46	7555,03	5239,86	2374,50	5668,78	195,14	15,88	36,20	29,74
	Mean	0,89	187,83	7664,76	4851,25	2792,84	5924,90	219,29	15,24	36,60	26,98
	δ	0,04	4,32	219,64	265,74	224,04	179,32	16,57	1,39	0,83	3,14

As given in Table 1 and Table 2, the genotypes with the highest values are given below**. In bread wheat (*Triticum aestivum* L.) genotypes; Bezostaja genotype;** lipid content, palmitoleic erusic, lauric, myristic, stearic, vitamin B_6, vitamin C, serine, trytophane, Zn. **Yunus genotype;** Linoleic/linolenic, SOD, asparagine, thionine, alanine, tyrosine, methionine, leucine, hydroxy proline, sarcosine, K and Fe. **Altay genotype;** linolenic, palmitic, CAT, vitamin A, vitamin B_1, glutamine, aspagine, glycine, lycine, Ca, Mn. **Müfitbey genotype;** caproic, luroleic, POD, vitamin B_2, histidine, phenylalanine, N, Na and Cu. **Nacibey genotype;** APX, glutamine, arginine, cysteine, isoleucine, proline, Mg and P. In **In oat (*Avena sativ*a L.) genotypes; Checota genotype;** palmitoleic, erusic, lauric, myristic, stearic, linolenic/vitamin B_1, vitamin B_6, glutamine, glycine, arginine, methionine, trytophane, phenylalanine, lysine, Na and Mg. **Seydişehir genotype;** CAT and isoleucine. **Yeniçeri genotype;** lipid content, linolenic, vitamin B_2, histidine, alanine, Fe, Mn. **Kırıklar genotype;** caproic, lauroleic, POD, APX, vitamin A, aspartate, asparagine, serine, tyrosine, hydroxy proline, sarcosine, N, K, Ca, P, Cu and Zn. **Kahraman genotype;** palmitic, SOD, vitamin C, glutamine, thionine, cysteine, leucine and proline. **In barley (Hordeum vulgare L.) genotypes; 4193 genotype;** lipid content, glycine and isoleucine. İnce genotype; SOD, vitamin B_1, vitamin B_6, glutamine, arginine, cysteine, tryptophan, lysine and proline. **5252 genotype;** linoleic/linolenic, N, K, Ca, Mg, Cu, Mn and Zn. **Özdemir genotype;** palmitic, POD, vitamin B_2, histidine, phenylalanine and Fe. **Ünver genotype;** caproic, laurolic, palmitoleic, linolenic, erusic, lauric, myristic, stearic, CAT, APX, vitamin A, aspartate, asparagine, serine, threonine, alanine, tyrosine, methionine, leucine, hydroxy proline, sarcosine, Na and P. **In safflower (*Carthamus tinctorius* L.) genotypes; Yenice genotype;** lauroleic, CAT, vitamin C and glutamine. **Dinçer genotype;** asparagine, serine, glycine, alanine, tyrosine, cysteine, isoleucine, sarcosine, N, Na, P and Zn. **Balcı genotype;** palmitoleic, erusic, lauric, myristic, stearic, vitamin B_1, thionine, tryptophan, leucine, hydroxy proline, K, Mg, Fe and Mn. **Linas genotype;** caproic, POD, APX, vitamin B_2, vitamin B_6, arginine, lysine, Ca and Cu. **Olas genotype;** lipid content, linolenic, linoleic/linolenic, POD, APX, vitamin B_6, histidine, methionine, phenylalanine and proline. **In bread wheat,** the genotype numbers were almost equal in terms of having the highest value.

The numbers of genotypes with the highest values in terms of components were similar. In barley, İnce and Ünver genotypes had the highest values in more components than other barley genotypes. In oats, Checota and Kırıklar genotypes are the genotypes with the highest values, making them a clear difference compared to other oat genotypes. In safflower, except for Yenice and Linas, Dinçer, Balcı and Olas genotypes had the highest values in more components. On average, oats and barley showed higher quality performance in more components than wheat and safflower. In this case, barley and oat oil are of higher quality than wheat and safflower lipid.

Hierarchical cluster analysis is a multivariate statistical method used to determine whether a data set contains different groups and, if so, to identify these groups. The assumptions of normality, linearity and homogeneity, which have an important place in this method, are considered sufficient in this method [26]. Hierarchical cluster analysis is one of the unsupervised machine teaching methods. The aim of this method is to divide observations into subsets according to their similarities to each other. However, the separation into clusters here occurs hierarchically [27-28]. The hierarchical cluster analysis performed to reveal the differences between the components examined in the hierarchical cluster analysis performed by performing F tests and to identify the components with significant differences is given in Table 3. As a result of hierarchical cluster analysis, differences between all genotypes in bread wheat, barley, oats and safflower were found to be significant at the 5%/1% level. **In bread wheat;** Linolenic, linoleic, butyric, POD, SOD, APX, vitamin A, vitamin B_2, vitamin B_6, vitamin C, asparagine, glycine, Na, Fe, Mn and linoleic/linolenic components were found to be important at 5%/1% level. **In barley;** APX, vitamin B_1, vitamin B_2, vitamin B_6, vitamin C, asparagine, glutamine, histidine, glycine, thionine, arginine, tryptophan, phenylalanine, isoleucine, lysine, hydroxy proline, N, Na, K, Ca, Mg, P, Fe The differences between Cu, Mn and Zn components were determined to be significant at the 5%/1% level.

In oat; lauroleic, palmitoleic, myristic, POD, APX, vitamin B_1, vitamin B_2, vitamin B_6, aspartate, asparagine, glutamine, histidine, glycine, arginine, alanine, tyrosine, valine, methionine, tryptophan, lysine, Na, K, Mg and linoleic The differences between /linolenic components were found to be significant at the 5%/1% level. In safflower; Differences between lipid content, palmitoleic, oleic, linolenic, linoleic, butyric, myristic, SOD, aspartate, asparagine, serine, alanine, cysteine, valine, methionine, tryptophan, isoleucine and sarcosine were significant at the 5%/1% level. As a result, asparagine, glycine, APX, vitamin B_2, vitamin B_6 were determined to be more effective components than other components in the production of quality seed oil for all genotypes in bread wheat, barley, oats and safflower.

Table 3. Hierarchical cluster analysis performed to identify components that have significant differences among the components examined.

WHEAT	Cluster				Cluster		
Genotype	Mean Square	df	F	Genotype	Mean Square	df	F
Bezostaja	169734854,50	2	298,68**	Müfitbey	166806986,05	2	280,78**
Yunus	165676847,83	2	283,53**	Nacibey	172816233,44	2	250,31**
Altay	182216381,30	2	312,41**				
Variable	Mean Square	df	F	Variable	Mean Square	df	F
Linolenic	3,75	2	7,85*	vitamin B_6	26,69	2	5,96*
Linoleic	48,97	2	7,24*	vitamin C	0,06	2	5,66*
Butyric	0,00	2	18,00*	Asparagine	1204237,03	2	295,38**
POD	1,01	2	12,71*	Glycine	2986,26	2	7,42*
SOD	0,63	2	11,62*	Na	451,63	2	5,79*
APX	0,12	2	12,41*	Fe	187,90	2	7,62*
vitamin A	4,43	2	8,39*	Mn	4,734	2	6,37*
vitamin B_2	20,38	2	8,36*	Linoleic/Linolenic	0,17	2	7,52*
BARLEY	Cluster				Cluster		
Genotype	Mean Square	df	F	Genotype	Mean Square	df	F
4193	321900122,92	1,00	185,43**	Özdemir	485073356,37	1,00	341,52**
İnce	316597502,82	1,00	161,91**	Ünver	486061206,34	1,00	334,40**
5252	502617533,77	1,00	327,86**				
Variable	Mean Square	df	F	Variable	Mean Square	df	F
APX	0,08	2	4,63*	Isoleucine	23023,10	1,00	6,07*
vitamin B_1	11,68	2	7,57*	Lysine	61890,66	1,00	5,07*
vitamin B_2	12,53	2	6,86*	Hydroxy proline	74297,21	1,00	10,14*
vitamin B_6	11,23	2	8,19*	N	0,52	1,00	21,14**
vitamin C	0,10	2	10,06*	Na	35369,48	1,00	5,44*
Asparagine	1739828,88	2	4,80*	K	13029541,73	1,00	14,87*
Glutamine	5529580,80	2	7,55*	Ca	11131489,83	1,00	17,11**
Histidine	915,14	2	6,86*	Mg	2975216,83	1,00	18,41**
Glycine	3891,82	2	8,15*	P	19082558,34	1,00	24,36**
Thionine	4576,08	2	10,06*	Fe	32953,75	1,00	20,36**
Arginine	50473,52	2	10,01*	Cu	100,29	1,00	14,34*
Tryptophane	87589,67	2	6,97*	Mn	591,23	1,00	14,09*
Phenylalanine	5179,69	2	4,85*	Zn	581,94	1,00	19,56**
OAT	Cluster				Cluster		
Genotype	Mean Square	df	F	Genotype	Mean Square	df	F
Checota	177788380,31	2,00	222,86**	Kırıklar	183134966,26	2,00	313,33**
Seydişehir	173828319,18	2,00	283,09**	Kahraman	178992044,80	2,00	291,35**
Yeniçeri	174324175,56	2,00	316,00**				
Variable	Mean Square	df	F	Variable	Mean Square	df	F
Lauroleic	0,04	2	6,15*	Glycine	4973,43	2	16,11*
Palmitoleic	0,02	2	6,54*	Arginine	34328,92	2	31,83**
Myristic	0,02	2	9,02*	Alanine	1295526,21	2	24,30**
POD	0,31	2	7,29*	Tyrosine	2385,98	2	5,77*
APX	0,05	2	15,13*	Valine	6863,42	2	8,57*
vitamin B_1	6,23	2	7,42*	Methionine	5130,77	2	2,84*
vitamin B_2	18,66	2	7,01*	Tryptophane	117339,26	2	11,47*
vitamin B_6	14,34	2	16,03*	Lysine	54879,76	2	20,05*
Aspartate	87026,81	2	7,29*	Na	114,84	2	25,25**
Asparagine	1034466,48	2	14,11*	K	17346,67	2	6,68*
Glutamine	2958394,81	2	7,43*	Mg	62494,01	2	23,60**
Histidine	1360,74	2	7,02*	Linoleic/Linolenic	0,25	2	5,64*
SAFFLOWER	Cluster				Cluster		
Genotype	Mean Square	df	F	Genotype	Mean Square	df	F
Yenice	188104430,23	2	266,97**	Linas	165026714,48	2	Linas
Dinçer	196003637,46	2	297,19**	Olas	161736887,29	2	Olas
Balcı	160443389,98	2	217,30**				
Variable	Mean Square	df	F	Variable	Mean Square	df	F
Oil Content	94,42	1	22,17**	Asparagine	1252762,09	1	5,34*
Palmitoleic	0,08	1	13,60*	Serine	11103,30	1	5,67*
Oleic	55,77	1	11,22*	Alanine	1595343,76	1	9,49*
Linolenic	17,81	1	6,59*	Cysteine	30138,16	1	17,37**
Linoleic	367,41	1	9,81*	Valine	7234,89	1	5,37*
Butyric	0,00	1	6,10*	Methionine	10713,77	1	4,70*
Myristic	0,03	1	10,40*	Tryptophane	35321,09	1	4,90*
SOD	0,01	1	6,64*	Isoleucine	62705,79	1	12,36*
Aspartate	68717,44	1	5,22*	Sarcosine	187770,10	1	6,40*

Biplot analysis is a method in which row and column level data with many variables are presented [29]. In agricultural research, two-way data analysis of the number of factors and components examined and the changes that occur depending on them is successfully performed with biplot analysis [30-31]. The biplot analysis showing the performances of the examined components and genotypes is given in Figure 1.

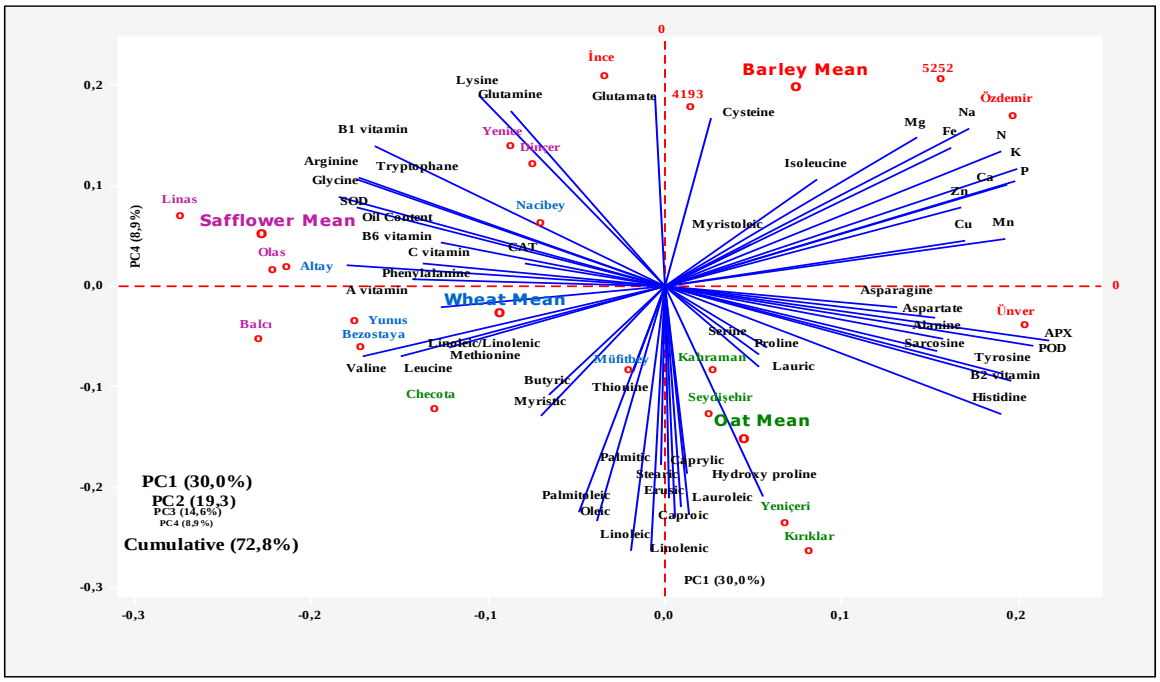

Figure 1. Biplot chart showing the performances of the components and genotypes examined.

As can be seen from the figure, all four plant species are distributed in different regions. In other words, the genotypes of the four species generally showed different performances in terms of the components examined. While minerals form one group, amino acids form a separate group. Again, enzymes constitute a separate group. Barley and oat genotypes had superior performance than wheat and safflower genotypes. This shows that barley and oats are of high quality and rich in chemical content. Özdemir and Ünver genotypes were determined as superior performing and stable genotypes.

In conclusion; in bread wheat, the numbers of genotypes with the highest values in terms of components were similar. **In barley,** İnce and Ünver genotypes had the highest values in more components than other barley genotypes. **In oats,** Checota and Kırıklar genotypes are the genotypes with the highest values, making them a clear difference compared to other oat genotypes. **In safflower,** except for Yenice and Linas, Dinçer, Balcı and Olas genotypes had the highest values in more components. Asparagine, glycine, APX, vitamin B_2, vitamin B_6 were determined to be more effective components than other components in the emergence of quality seed oil in bread wheat, barley, oats and safflower for all genotypes. Barley and oat genotypes showed superior performance compared to wheat and safflower genotypes. This shows that barley and oats are of higher quality and richer in terms of chemical content. Özdemir and Ünver genotypes were determined as superior performing and stable genotypes. Seed oil is rich in ingredients. Mostly, the seed oil found in the embryo has a significant effect on plant development. Seed oil is of vital importance in metabolic events including plant growth, development and dry matter production. Again, their importance is

increasing as they are used for various purposes. A better understanding of the subject can be achieved through more detailed studies on this subject.

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