

Production of Chickpeas in Montana

Montana chickpea yields, while quite variable, are comparable to yields grown in the major states that produce most U.S. chickpeas for market.

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Introduction

Chickpea (*Cicer arietinum* L.), also known as garbanzo bean, is one of over 18,000 species within the pea and bean family *Leguminosae*. Chickpeas are thought to have originated in India, central Asia, the Near East and Mediterranean (2).

Chickpeas are second to dry beans in use for human food, and third in overall production acreage to dry beans. India produces 90 percent of all chickpeas used for human consumption. Ethiopia, Mexico, Argentina, Chile, Australia and its areas of origin have significant chickpea production.

The two major types of chickpeas used for human food are the kabuli (large, rounded light-colored seeds) and the desi (variably colored, irregular shaped small seed with a thick irregular husk that must be removed prior to processing for food). Kabuli types produce seeds which weigh about one ounce per 100 seeds, compared to desi types which produce seed weighing less than that. World wide, the desi types represent 85 percent of the total chickpea

production. Chickpeas have 13 to 33 percent protein, 40 to 55 percent carbohydrate and four to 10 percent oil (2,6,7). Used as a food in numerous ways, chickpeas can be served whole or processed into flour for snacks or sweets (3). Chickpea consumption also has been reported to lower cholesterol and triglycerides (3).

Most chickpeas grown in the United States are large seeded kabuli types, with only a limited production of the small seeded desi types. California is the primary producer of chickpeas in the United States, with about 16,000 acres, followed by Washington with 5,500 acres and Oregon and Idaho at 1,300 acres each. U.S. yield averages range from 1,100-2,400 lbs/acre for dryland production.

U.S. chickpea production is about 20,000 tons/year. *Ascochyta* leaf blight is a major limiting factor in U.S. chickpea production. However, several new chickpea varieties released by Washington State University have a degree of resistance to the blight.

Kabuli type chickpeas are marketed in the United States based on size and color. Size grades range from jumbos (42-48 seeds/oz) large (48-52 seeds/oz) medium (54-58 seeds/oz) and small (over 60 seeds/

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oz). Light-colored seeds free of discoloration are most desirable. Dark types are not marketed based on seed size or seed color.

Kabuli chickpeas marketed for the canning processors in the United States must be at least graded medium with preference given to seed lots grading large or jumbo.

Previous studies on dryland chickpea production were initiated at the Southern Agricultural Research Center at Huntley in 1988. In 1988, growing season precipitation averaged 4 inches below normal--a drought. Dryland barley yields that year averaged less than 10 bushels/acre, (compared to a typical yield of 45 to 55 bu/acre) at SARC, while chickpea yields ranged from 1,082 to 1,479 lbs/acre. In addition to the significant seed yield in a drought year, the chickpeas were not devastated by grasshoppers, as were other crops. This is likely due to high levels of tannic acids characteristically found in chickpea leaves which repel many insects. In 1989, the average yield for chickpeas was 1,400 pounds per acre compared to field pea yields of 640, and lentil yields of 450 pounds per acre, while barley yields

averaged 50 bushels per acre, typical yields for SARC.

The primary objective of this study was to evaluate the production of kabuli and desi chickpea types for yield, seed size and color, and evidence for *Ascochyta* leaf blight under a range of Montana environments. The secondary objective was to compare the chickpea yields and agronomic characteristics to the primary pulse crops grown in Montana.

Materials and Methods

'Sarah' and 'Garnet' (desi), 'UC-5' and 'Suratato' (kabuli) chickpea varieties, 'Melrose' Austrian winter pea, 'Umatilla' field pea, and 'Brewer' and 'Crimson' lentil were evaluated for grain and plant residue yield in 1990, 1991, 1992. The annual legume trials were planted on dryland recrop at Bozeman, Conrad and Moccasin, on dryland crop fallow at Huntley and Sidney, and under irrigation at Corvallis. The legumes were planted at 95 lbs/acre (desi) and 125 lbs/acre (kabuli) for chickpeas, 120 lbs/acre for the field peas, and 65 lbs/acre for the lentils.

Table 1. Comparison of large-seeded (Kabuli) and small-seeded (Desi) chickpeas grown in Montana in 1990

Location/Cultivar	Yield in Lbs/Acre						Average
	Conrad	Moccasin	Corvallis	Bozeman	Sidney	Huntley	
Sarah Desi	1986	644	3008	1238	1668	1509	1768
Garnet Desi	1902	961	1774	1063	1531	1688	1510
UC-5 Kabuli	1717	682	816	596	1319	1465	1212
Suratato Kabuli	1358	504	807	319	940	1360	967
Umatilla Fp	1844	362	1688	1076	1113	792	1449
Austrian Wp	1708	422	663	928	999	886	1076
Brewer Lntl	1516	343	591	781	966	636	882
Crimson Lntl	1430	215	310	902	1152	601	790
LSD 0.05	657	127	481	224	230	230	
Bowman Barley		1766		3226	2654	3480	2782
bushels per acre		37		67	54	72	58

Chickpea Seed Weight in Grams per 100 Seed

Sarah	-----	14	11	13	15	16	14
Garnet	-----	16	12	14	17	18	16
UC-5	-----	37	30	37	44	45	39
Suratato	-----	47	48	44	54	56	50
Umatilla Fp	-----	18	18	23	22	22	21
Austrian Wp	-----	10	10	10	12	12	11
Brewer Lentil	-----	5	5	7	7	7	6
Crimson Lentil	-----	5	3	3	3	4	4

Table 2. Yield and seed weight of large seeded (Kabuli) and small seeded (Desi) type chickpeas in comparison to other crops 1991

Yield Lbs/Acre								
Location/Cultivar	Conrad	Moccasin	Corvallis	Bozeman	Sidney	Huntley	Havre	Average
Sarah (Desi)	2542	288	4543	4336	1732	2419	----	2643
Garnet (Desi)	2041	281	3306	3420	1554	2146	----	2125
UC-5 (Kabuli)	2392	393	3682	4141	1375	2248	----	2372
Suratato (Kabuli)	1873	281	2257	3802	1419	1808	----	1907
Umatilla Fp	3661	96	2764	2072	1798	2284	----	2112
Austrian Wp	2560	241	2954	1891	1091	1524	----	1710
Brewer Lentil	1675	426	858	1381	1282	1680	----	1217
Crimson Lentil	1561	481	1276	2062	1202	1531	----	1352
Bowman Barley	4402	Hail	----	3475	3370	4051	----	3824
<i>bushels per acre</i>	92	Hail	----	72	70	84	----	80
LSD 0.05	156	156	858	954	322	346	----	----

Seed Weight Grams/100seed								
Location/Cultivar	Conrad	Moccasin	Corvallis	Bozeman	Sidney	Huntley	Havre	Average
Sarah (Desi)	----	8	8	16	13	15	----	14
Garnet (Desi)	----	9	9	17	15	17	----	15
UC-5 (Kabuli)	----	23	46	42	40	43	----	39
Suratato (Kabuli)	----	25	52	52	50	51	----	46
Umatilla Fp	----	9	27	23	----	23	----	20
Austrian Wp	----	9	13	13	----	11	----	11
Brewer Lentil	----	4	8	6	----	7	----	6
Crimson Lentil	----	3	5	4	----	4	----	4

Table 3. Yield and seed weight of large seeded (Kabuli) and small seeded (Desi) type chickpeas in 1992

Yield Lbs/Acre								
Location/Cultivar	Conrad	Moccasin	Corvallis	Bozeman	Sidney	Huntley	Havre	Average
Sarah (Desi)	----	1846	1381	2024	3081	3269	1398	2166
Garnet (Desi)	----	2785	2598	1861	2610	2467	1470	2298
UC-5 (Kabuli)	----	1132	1603	1341	2409	1761	528	1462
Suratato (Kabuli)	----	1854	1380	1147	2515	1582	335	1469
Umatilla Fp	----	2066	1455	2179	2856	4215	843	2269
Austrian Wp	----	2041	1621	1601	2126	2689	1100	1863
Brewer Lentil	----	1229	2107	987	1750	2906	1463	1740
Crimson Lentil	----	1393	2042	1132	2048	2993	1365	1829
Bowman Barley	----	3494	----	5515	5078	5573	Hail	4915
<i>bushels per acre</i>	----	73	----	115	106	116	Hail	102
LSD 0.05	----	605	----	619	409	771	----	----

Seed Weight Grams/100seed								
Location/Cultivar	Conrad	Moccasin	Corvallis	Bozeman	Sidney	Huntley	Havre	Average
Sarah (Desi)	----	12	13	----	15	14	----	14
Garnet (Desi)	----	15	18	----	17	16	----	16
UC-5 (Kabuli)	----	24	36	----	41	37	----	34
Suratato (Kabuli)	----	40	40	----	54	47	----	45
Umatilla Fp	----	24	23	----	----	25	----	23
Austrian Wp	----	12	9	----	----	10	----	10
Brewer Lentil	----	5	6	----	----	6	----	6
Crimson Lentil	----	3	3	----	----	3	----	3

The trials were planted as replicated plots and yield data was analyzed by MSUSTAT, AVIT, developed by Richard Lund, MSU. Data was collected on date of flowering, plant height, seed yield, size and residue yield. The yield of Bowman barley in the respective study years is included in the results as pounds/acre and bushel/acre for yield comparison.

Results

The yield ranges of the annual legumes among the research center sites were extremely variable from year to year (Tables 1-3).

Differences in growing season are also reflected in the yield of Bowman barley averaged over locations for each respective year. Bowman barley yields averaged 58, 80, and 102 bushel/acre for the years 1990, 1991, and 1992. However, yields of the chickpea and other annual legume species did not necessarily follow the same increasing yield trend for the years 1990-1992. The yield variation among the research centers within specific years could be the result of growing season precipitation, growing degree days (GDD), length of frost free season, and temperature at time of flowering. In general, chickpea yields of both the kabuli and desi types were higher than the yields of Austrian winter peas and lentils, while Umatilla field pea yields were comparable to the chickpeas. The desi type chickpeas and Umatilla field peas responded most to high moisture conditions. The 1991 results at Moccasin and 1992 results at Havre indicate that annual legumes can tolerate hail, which destroyed the cereal crops at these locations.

Seed weight of the kabuli chickpeas ranged from just under one ounce to just under two ounces per 100 seeds at the various sites during the three year study, (Tables 1-3). The kabuli suratato variety consistently produced larger seeds when compared to the UC-5 variety. Seed color quality was excellent for kabuli varieties. *Ascochyta* leaf blight was not observed in the trials conducted in the study.

Dry matter residue, plant heights and date of 50 percent flowering for the annual legumes are described in Table 4. Agonomic characteristics evaluated over station-years indicated that the plant

residue yields, plant heights and date of 50 percent flowering were similar among the kabuli chickpea types and lentil varieties.

Summary and Conclusions

Results of this three year study indicate that chickpea yields, while quite variable under the various Montana environments are comparable to yields grown under dryland or high moisture regions in California, Washington, Idaho and Oregon. Kabuli type chickpeas grown in Montana meet the required color for marketable goods. Seeds were free of seed coat blemishes and were the desired light tan color. The requirement for a consistent minimum size of 1.7 ounces per 100 seeds could exclude certain shorter-season dryland environments, such as Moccasin, as potential production areas.

A significant constraint in the production of chickpeas in the present production states is the presence of viruses, the high incidence of *Ascochyta* leaf blotch and soil borne fungal diseases. The large dryland acreage in Montana would allow producers to use long rotations which would minimize disease and insect vector problems.

Actual market potential for large acreage production of chickpeas in Montana will depend upon broker contracts for either domestic or export markets. Limited market potential exists for production of organic grown chickpeas for domestic uses as soup ingredients, specialty dishes or baked goods.

Table 4. Dry matter yields, plant heights and date of 50 percent flowering of chickpeas and selected annual legumes averaged over years and locations.

Cultivar	Average dry matter 8 station years	Average plant height 12 station years	Average flowering date 5 station years day of yr date
Sarah (Desi)	1.83	12	182 7/1
Garnet (Desi)	2.13	13	183 7/2
UC-5 (Kabuli)	2.07	15	182 7/1
Suratato (Kabuli)	1.83	14	183 7/2
Umatilla Fp	1.81	20	179 6/28
Austrian Wp	2.34	24	187 7/6
Brewer Lentil	1.84	12	180 6/29
Crimson Lentil	1.74	11	184 7/3

*Huntley 1990, 1991, 1992; Moccasin 1990, 1991, 1992 Severe Hail 1991; Conrad 1991; Corvallis 1990, 1991, 1992; Bozeman 1990, 1991, 1992, Sidney 1990, 1991, 1992.

Numerous chickpea production guide bulletins (1,4,5,8,9) are available. The authors suggest that producers interested in considering chickpeas as an alternate crop consult these bulletins, which cover information on cultural and marketing aspects of chickpea production.

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