# 2007 DRY BEAN YIELD TRIALS

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Nineteen yield trials were conducted in 2007 in Saginaw, Montcalm, Kalamazoo and Gratiot counties in addition to 20 acres of early generation nurseries under development in 10 different market classes. At the Saginaw Valley Bean & Beet Research Farm, 10 yield trials were planted. These included the standard nurseries in small and medium-sized market classes, the Cooperative Dry Bean, and the Midwest Regional Performance Nurseries. All yield trials at Saginaw were direct harvested, except vine cranberry and bush tebo tests. The large-seeded kidney, cranberry and white mold trials at Montcalm were rod-pulled. The yield trials included 42-entry navy test; one 36-entry standard black test; 100-entry black test from 115M/Jaguar cross; 42-entry black test from 26-11M, 48-21M, 39-11M lines crossed to Jaguar; 56-entry GN test; 56-entry pinto test; 30-entry red/pink test; Otebo test with 16 lines with BCMV resistance; 36-entry coop and regional test that includes pinto, GN, red and pinks; and 16-entry vine cranberry test. At Montcalm Research farm tests included: 42-entry bush cranberry test; two kidney tests with 30 and 64-entries; three white mold tests one with 64-entries and two 96-entry pinto trials including the National *Sclerotinia* Dry Bean Nursery. Two certified organic trials one 32-entry test at the Kellogg Biological Station - KBS and second 32-entry test in Gratiot county were planted. All trials except kidney, cranberry, Otebo and the organic trials were direct harvested.

Despite a favorable planting season, the lack of precipitation in June following planting severely reduced plant growth in Saginaw but there was excellent recovery in the longer season small-seeded classes such as navy and black beans due to more favorable rainfall amounts in late July and August. Yields averaged 25 cwt/acre and the best lines exceeded 30 cwt/acre, but yields were overall lower in the earlier season pinto, great northern, red and pink beans. No major disease problems were encountered in 2007. Higher temperatures limited the spread of white mold despite access to irrigation at Montcalm. Rainfall (June-September) averaged 10.24” at Montcalm with only 1.3” in September. Overall trails at Montcalm were excellent in 2007 and yields were high, exceeding 33 cwt/acre in cranberry and kidney tests and 42 cwt/acre in the white mold test, where the overall mean yield exceeded 32 cwt/acre.

Two companion nurseries of 32-entries each were planted one in certified organic and one in conventional plots to compare genotypic response to the different management systems. Trials planted in certified grower”s field in Gratiot county received favorable rains but severe drought at the KBS site in June delayed maturity and resulted in very significant regrowth in some plots. Weeds were controlled by cultivation and insects (potato leaf hoppers) were controlled with multiple sprays of pyganic in the organic plots. The conventional plots received normal recommended rates of fertilizer, herbicides and insecticides, otherwise all other practices were similar between plots. The organic plots in Gratiot had received animal (turkey) manure in the fall prior to planting whereas any residual N in the organic plots at KBS would have come from forage legumes in the rotation. Every attempt was made to handle the plots in a similar fashion so that valid comparisons could be made between treatments.

The data for all tests are included in an attached section. Procedures and details on nursery establishment and harvest methods are outlined on the first page. Since the data collected on each test are basically the same, a brief discussion of each variable measured is presented below for clarification purposes.

1. Yield is clean seed weight reported in hundredweight per acre (cwt/acre) standardized to 18% moisture content. Dry beans are commercially marketed in units of 100 pounds (cwt).

2. Seed weight is a measure of seed size, determined by weighing in grams a pre-counted sample of 100 seeds, known as the 100-seed weight. To convert to seeds per 100g (10,000/100 seed wt); for example 100-seed weight of 50 converts to 200 seeds per 100 g (used in marketing).

3. Days to flower is the number of days from planting to when 50% of plants in a plot have one or more open flowers.

4. Days to maturity is the actual number of days from planting until date when all the plants in a plot have reached harvest maturity.

5. Lodging is scored from 1 to 5 where 1 is erect while 5 is prostrate or 100% lodged.

6. Height is determined at physiological maturity, from soil surface to the top of plant canopy, and is recorded in centimeters (cm).

7. Desirability score is a visual score given the plot at maturity that takes into consideration such plant traits as; moderate height, lodging resistance, good pod load, favorable pod to ground distance, uniformity of maturity, and absence of disease, if present in the nursery. The higher the score (from 1 to 9) the more desirable the variety, hence DS serves as a subjective selection index.

At the bottom of each table, the mean or average of all entries in a test is given to facilitate comparisons between varieties. In order to better interpret data, certain statistical factors are used. The LSD values refer to the Least Significant Difference between entries in a test at two levels of probability. The LSD value is the minimum difference by which two entries must differ before they can be considered significantly different. Two entries differing in yield by 1 cwt/acre cannot be considered as performing significantly different if the LSD value is greater than 1 cwt/ acre. Such a statement is actually a statement of "probable" difference. We could be wrong once in 20 times (p=0.05), on the average, or once in 100 times (p=0.01) depending on the level of probability. The other statistic, Coefficient of Variation (CV), indicates how good the test was in terms of controlling error variance due to soil or other differences within a location. Since it is impossible to control all variability, a CV value of 10% or less implies excellent error control and is reflected in lower LSD values. Under the pedigree column, all released or named varieties are **bolded** and always preceded by a comma (,); when preceded by a slash (/), the variety was used only as a parent to produce that particular breeding line.

**Expt. 7101: Standard Navy Bean Yield Trial**

This 42-entry trial included standard commercial navy bean varieties, and advanced lines from the MSU breeding program, which carry the N-prefix. Yields ranged from 18 to 30 cwt/acre with a mean of 24 cwt/acre. The trial was fairly uniform and variability was moderate (CV=8.2%) and the LSD needed for significance was 2.8 cwt/acre. Eight entries significantly out-yielded the test mean and included N05324 which ranked 1st and 2nd in 2006 and exhibited upright architecture, and high DS score, followed by N05311 and Vista. The top-yielding navy entry N06701 in test 6103 is a sib of N05324 and ranked 7th in this test. Only one new line N07009 appeared in the top group with an old line N01453 which had a very low DS score as it had a decumbent growth habit. The two check varieties Seahawk and Mayflower ranked above the mean.

**Expt. 7102: Standard Black Bean Yield Trial**

This 36-entry trial included the standard commercial black bean varieties and advanced breeding lines. Yields ranged from 21 to 31 cwt/acre with a test mean of 27 cwt/acre. Variability was very well controlled in this test, (CV=6.7%) and the LSD was 2.5 cwt/acre. Seven breeding lines significantly out-yielded the test mean and included the varieties Shania and Jaguar. B04554 that topped the test in 2005 was 3rd in 2006 and ranked 2nd in this test continues to show potential. Two new lines B06309 and B06311 (sibs) ranked 1st and 3rd and were derived from B01741 that previously topped tests in 2002 and 2003, and ranked 2nd in 2006. B04316 was in the top group whereas none of the CBB resistant lines were in the elite group. Among the top yielding varieties were Condor (27.9) and Domino (26.9), whereas Bandit (26.4) and T-39 (23.1) were below the test mean. Since the trial was direct harvested, the data suggest that there exists significant yield potential in upright black beans adapted to the current conditions of mid-Michigan. Future advances will largely depend on canning quality of the entries.

**Expts. 7103: Black Bean-115MYield Trial**

This trial was established to study inheritance of high yield in black beans derived from an original cross with the Mexican black bean Tacana and a wild bean G24423 from Colombia. The most consistent high yielding line 115-11M was crossed with Jaguar and advanced using SSD to the F5 generation and the recombinant inbred lines (RILs) from this cross entered the fourth year of yield testing in 2007. Test 7103 derived from cross 115-11M/Jaguar had 100 entries and ranged in yield from 21 to 33 cwt/acre with a mean of 27 cwt/acre. Variability was very well controlled in this 3-rep test (CV=6.9%) despite being direct harvested and the LSD was 3.1 cwt/acre resulting in 6 lines that significantly outyielded the test mean. The top yielding entries B04391 ranked 1st as in 2006 and B04431 ranked 2nd as in 2006 and B04404 that ranked 6th previously ranked 1st and 4th in 2004 and 2005, respectively. Varieties ranged in yield 115M (28.5), Jaguar and Tacana (27.0) were equivalent to the test mean whereas T-39 (24.5) was below the test mean.

**Expts. 7104: Combined Black Bean Yield Trial**

Three trials were established to study inheritance of high yield in black beans derived from an original cross with the Mexican black bean Tacana and a wild bean G24423 from Colombia. Four high yielding lines were identified in this cross: 48-21M (MSU accession I01891), 26-11M

(I01893), and 39-11M (I01894). The three lines were crossed with Jaguar and advanced using SSD to the F5 generation and only the best recombinant inbred lines (RILs) from these crosses entered fourth year of yield testing in 2007. The combined test 7104 had 42 entries and ranged in yield from 24 to 31 cwt/acre with a mean of 28 cwt/acre. Variability was very well controlled in this 3-rep test (CV=5.7%) despite being direct harvested and the LSD was 2.6 cwt/acre resulting in only two lines that significantly outyielded the test mean. The two top entries B04265 and B04492 ranked 5$^{th}$ and 11$^{th}$ in 2006, followed by B04301 (11$^{th}$ in 2006). The anthracnose resistant line B04587 ranked 4$^{th}$ and continues to perform well. Only Jaguar and 115M with yields of 28.8 and 27.9 cwt/acre, respectively and B04554 that ranked 8$^{th}$ outyielded the test mean whereas the other three parents including the original parent Tacana yielded below the test mean.

**Expt. 7105: Standard Great Northern Bean Yield Trial**

This 56-entry trial included MSU great northern breeding lines and standard commercial check varieties. The test ranged in yield from 17 to 24 cwt/acre with a mean yield of 20 cwt/acre. Variability was well controlled (CV= 7.9%) resulting in a low LSD value (2.3 cwt/acre) for significance. Eight breeding lines significantly outperformed the test mean. The group included four new lines (coded G07-), two lines G05239 and G05220 that had very large seeds, and G06207 that ranked 1$^{st}$ in 2006. This was the first year that Matterhorn did not yield in the top group and only performed equal to the test mean (20.4). The lower yield may be a reflection that the trial was direct harvested. We plan to continue to direct harvest this trial in future years to determine which lines are best suited for this harvest method. A group of entries with seed size under 30g that were derived from crosses with navy beans will be trailed with Tebo bean entries in future years. Only those entries with larger seed size, improved dry seed quality and cracking resistance over Matterhorn will be advanced in 2008.

**Expt. 7106: Standard Pinto Bean Yield Trial**

This 56-entry trial included standard commercial pinto bean varieties, breeding lines from USDA program in WA, and advanced lines from the MSU breeding program that carry the P-prefix. The trial ranged in yield from 8 to 27 cwt/acre with a mean of 21 cwt/acre. There was greater variability (CV=10.7%) in this trial than in past years and the LSD needed for significance was 3.2 cwt/acre. The trial was direct harvested which would explain the higher variability and lower yield of the more prostrate check varieties, Buster and Othello. Only four entries significantly out-yielded the test mean and these included the new La Paz variety. La Paz was among the latest maturing entries and had small seed (35.3g). Top entry P06125 derived from cross of two very erect MSU lines (P02646/P02630) had above average desirability based on plant height, lodging resistance and uniform maturity and larger seed. This cross produced a number of attractive, high-yielding, upright lines. The top-yielding entry P06131 in 2006 is a member of family but all lines will require continued testing before any decision will be made on release. P04205 is a member of family (P04202-P04206) that continue to show potential both in yield and large seed size (~38g) and is a candidate for release if it continues to perform well in white mold trials. Many of the entries from USDA-WA were very viny, prostrate and did not perform well in 2007 and one line was late maturing (>98d) which resulted in lower yield. Only those entries with more upright architecture and equivalent canning quality to Othello will be advanced in 2008.

**Expt. 7107: Standard Pink and Small Red Bean Yield Trial**

This 30-entry trial included small red and pink breeding lines from the USDA program at Prosser, Washington (USWA) and new pink lines from MSU (S-prefix), standard commercial check varieties. The test ranged in yield from 13 to 28 cwt/acre with a mean yield of 21 cwt/acre. Variability was high (CV=9.6%) due to direct harvesting resulting in a LSD value (2.8 cwt/acre) for significance. Six lines significantly outperformed the test mean and these represented the same family. Despite the higher yield, all lines in this family were more prostrate and longer maturing and are unlikely to have the stature needed of a new variety. Check varieties such as Merlot, Sedona and Brooks were lower yielding in 2007. A few new lines R06420 and R06422 exhibited nice dry down in the small red class but lacked seed quality of Merlot. Merlot continues to exhibit late maturing plants and it did produce 'buckskin' seed color following wet fall conditions. Only those small red entries equivalent to Merlot and pink lines equivalent to Sedona in canning quality will be advanced in 2008.

**Expt. 7108: Standard Tebo Bean Yield Trial**

This 16-entry trial is the part of the program to develop a Tebo (Otebo) medium white bean with resistance to Bean Common Mosaic Virus (BCMV). Tebo is a specialty class that is exported to Japan for preparation of 'An' paste. Included in the test are both third backcross (BC3; G04-Prefix), and fourth backcross (BC4; G05-Prefix) lines similar to Tebo with resistance to BCMV. Virus resistance came from Matterhorn parent and was backcrossed either 3 or 4-times to the Hime Tebo parent to recover Tebo plant and seed type. The test ranged in yield from 15 to 23 cwt/acre with a mean yield of 19 cwt/acre. Variability was high (CV=11.5%) resulting in a LSD value (3.1 cwt/acre) for significance, so only one line G05922 significantly outperformed the test mean. G05922 ranked 2$^{nd}$ in 2006, but it was not significantly higher than the Tebo check either year. Among the other G05-lines, G05915 that ranked 6$^{th}$ in 2006, yielded below the test mean in 2007. A high incidence of CBB in the trial may have contributed to lower yields and increased variability in this test. Most lines were similar in seed size (27g) and were a few days earlier in maturity (89 days) compared to the Tebo parent. Otherwise the lines resembled the Tebo parent in plant type, height and lodging resistance. A select group of the highest-yielding lines will be evaluated for their suitability in making An paste and any decision on lines to advance will depend on those results.

**Expt. 7109: Combined Midwest Regional Performance Nursery (MRPN) & Cooperative Dry Bean Nursery (CDBN) Yield Trial**

In 2007 the MRPN and CDBN nurseries were combined with the expectation of pulling the trial at harvest as many of the entries are not suitable for direct harvest. The decision to direct harvest the trial was based on overall limited plant growth and narrow maturity range. The MRPN is conducted annually in cooperation with North Dakota (ND-prefix), Nebraska (NE-prefix) and Colorado (CO-prefix) in order to test new pinto and great northern lines from all four programs and access their potential in the different regions. The CDBN is national and includes all classes but only medium-sized entries were included in this trial. The 36-entry trial ranged in yield from 11 to 29 cwt/acre with a mean of 21 cwt/acre. Variability was moderate (CV=8.1%) resulting in a LSD value (2.7 cwt/acre) for significance. As a result only six lines were significantly higher in yield than the test mean. The top yielding entries were all pintos and included two MSU lines P04204 and P06131, two lines from Colorado CO 33546 and CO 23704, new variety Stampede from North Dakota and an

erect pinto PT 7-8 from USWA. With the exception of the pink line PK 7-4 from Washington all entries above the test mean were pinto beans. The check varieties, Matterhorn, Buster and Othello yielding below the test mean as the trial was direct harvested. The exceptions were the two decumbent varieties, Kimberly and Montrose which yielded above the test mean. This cooperative trial continues to be valuable as it allows an evaluation of potential new lines prior to release in other states.

**Expt. 7110: Standard Vine Cranberry Bean Yield Trial**

This 16-entry trial was grown in Saginaw to identify those lines with improved performance over the check, Michigan Improved Vine Cranberry (Micran). The test included lines (coded C03-) from MSU developed from backcrossing bush cranberry line C97407 with NSL, a high-yielding root rot resistance vine black bean from Mexico. Included in the test were new lines (coded C05-, C06-), bush cranberry variety Capri and the check was the vine cranberry variety Chianti. Yields ranged from 15 to 25 cwt/acre with a mean of 19 cwt/acre. Variability was high in this test (CV=11.5%) and LSD value of 3.1cwt/acre was needed for significance. Only two lines significantly outyielded the test mean and the Chianti and Micran checks. The top entries had decumbent plant type and small seed size (39g). Capri continues to be the best bush cranberry bean in this non-irrigated trial. It was the largest seeded entry and has exhibited canning quality equivalent to Micran in contrast to the traditional bush cranberry varieties that do not can satisfactory. The check varieties performed poorly and the mediocre performance of Chianti raises concerns over its future potential. One new line C06808 with a more upright habit and larger seed showed the best potential in 2007. C05625, the top-yielding entry in Montcalm in 2006, ranked 6$^{th}$ in this test. Only those entries with equivalent canning quality to Micran will be advanced in 2008.

**Expt. 7211: Standard Bush Cranberry Bean Yield Trial**

This 42-entry trial was conducted on the Montcalm Research Farm to compare new and standard bush cranberry bean varieties under supplemental irrigation. Yields ranged from 16 to 34 cwt/acre with a mean of 23 cwt/acre. Variability was high (CV=14.6%) in this test and the LSD needed for significance was high (4.7 cwt/acre). Only two lines significantly outyielded the test mean and these included the new breeding line C07403 and USCR-CBB-20 line from USWA. Capri ranked third. The best new MSU entry C06814 that showed both yield potential and larger seed size in 2006 ranked 4$^{th}$ in this test and continues to show promise. The very large difference in yield (>6cwt) between the first and second entries might be reflective of the full season maturity (97d) of C07403. A few new breeding lines (C07-) in the test exhibited very favorable bush habit and maturity based on high DS scores >5.5 compared to Capri (3.5). Lines with seed weight under 50g may not have acceptable seed size. Only those entries equivalent to Capri in seed size and canning quality will be advanced in 2008.

**Expt. 7212: Standard Kidney Bean Yield Trial**

This 30-entry trial was conducted on the Montcalm Research Farm to compare the performance of standard and new light red kidney (LRK), dark red kidney (DRK) and white kidney (WK) bean varieties from MSU and CDBN under supplemental irrigation (3x total 1. 5”). Yields ranged from 13 to 25 cwt/acre with a mean of 19 cwt/acre. Variability was high (CV=16.6%) resulting in a large

LSD value (4.4 cwt/acre) needed for significance. Only three entries significantly outyielded the test mean and these included new LRK line K05602, WK line CBB-17 from USWA, and LRK line 773-V98 from Cornell. All three lines had small seed (42-46g) compared to commercial checks. LRK breeding line K03601, Chinook Select ranked 4$^{th}$ and outperformed Chinook 2000 in 2007. Other checks, CELRK, Red Hawk, Redcoat and Beluga were lower yielding and fell below the test mean. The new CBB resistant line (CBB-15) also fell below the test mean in 2007. Similar to 2006, the LRK class showed the best potential over WK which had performed well in previous years. Since canning quality is vital in kidney beans, only those DRK lines equivalent in canning quality to Red Hawk, LRK lines equal or better than CELRK and WK lines equivalent to Beluga will be advanced in 2008.

**Expt. 7213: Preliminary Kidney Bean Yield Trial**

This 64-entry trial was conducted to compare the performance of DRK, LRK and WK-kidney varieties with new kidney bean lines (K07-prefix), entries with (K06-prefix) that were damaged by wet weather in 2006, and lines from North Dakota under same supplemental irrigation at the Montcalm Research Farm. Yields ranged from 18 to 33 cwt/acre with a mean of 25 cwt/acre. Variability was very high (CV=17.5%) resulting in a large LSD value (7.1 cwt/acre) needed for significance. Four entries significantly outyielded the test mean and these included two new LRK-lines, and two WK-lines USWK-CBB-16 and K07921. Seed size of CBB-16 was small (44g). Montcalm Select outperformed Montcalm, Red Hawk and Beluga all of which yielded above the test mean. The two LRK-lines from North Dakota performed below the test mean due to long-season maturity. A major breeding effort is underway to incorporate the resistance in the CBB-lines into MSU kidney bean lines. Caution will be exercised in the advance of any of the lines in this test due to their susceptibility to CBB and the high variability present in the test. All entries will be canned prior to advance in 2008.

**Expt. 7214: White Mold Variety Yield Trial**

This 64-entry trial was conducted at Montcalm to evaluate a range of diverse dry bean varieties and breeding lines for reaction to white mold under natural field conditions. Genotypes included commercial navy and black bean cultivars, elite MSU lines, and new sources of white mold resistance entered as part of the National *Sclerotinia* Bean Trial and 13 putative transgenic genotypes (coded G07300) of Matterhorn great northern. Lines in the National trial were developed at MSU, OSU, CSU, Cornell, NDSU and USDA-WA. Entries were planted in two row plots with two rows of susceptible spreader variety Beryl between plots. Supplemental overhead irrigation was applied 13 times for a total of 6.5" to maintain adequate levels of moisture for favorable disease development at the critical flowering period. Natural white mold infection occurred across the entire trial and was extremely severe in certain plots. White mold was rated on a per plot basis on a scale of 1 to 9 based on disease incidence and severity where 9 had 90+% incidence and high severity index. White mold ranged from 11 to 90%. The test ranged in yield from 18 to 43 cwt/acre with a mean yield of 32 cwt/acre. Variability was high due to white mold pressure (CV=12.5%), thus a high LSD value (6.6 cwt/acre) was needed for significance. Despite the high disease pressure, seven lines significantly outyielded the test mean and the results are similar to data collected in 2006. Two black lines B05055 and B04316 that topped trial in 2006 and exceeded 40 cwt/acre were among the top entries with similar yields in 2007. Both black lines exhibited CBB resistance and continued to grow

when other entries had succumbed to disease. Two other entries, B05040 and N05357 in the top group have CBB resistance, suggesting that resistance is contributing to yield performance as the additional overhead irrigation promotes the development and spread of CBB in the trial. The highest yielding entry B07104 came from an inbred backcross line (IBL) population developed from the cross of Tacana*2/PI 318695. PI 318695 is a wild accession from Mexico. These lines have been screened for 4-years for resistance to white mold and appear to have improved levels of resistance. The two black lines in the top group were B03622 that topped yield trial in Saginaw in 2006 but has been inconsistent in yield and the high-yielding line 115M. The best small red was Merlot, followed by pinto P06131, GN line PS02-037-7-B2 from USWA, Capri cranberry and Sedona pink, all exceeded the test mean. Among the MSU varieties that produced disappointing yields below the mean were B04554, Jaguar, Condor, and Bunsi. Beryl GN that was used as a spreader and had the highest mold rating (90%) with a yield (26 cwt) which was over 8 cwt less than Matterhorn. Only one of the transgenic GN lines G07326 exceeded the yield of Matterhorn, and none showed enhanced levels of resistance over Matterhorn. The oxalate oxidase resistance gene does not appear to be expressed in these lines. Four lines [VA-19, G122, WM67, and Cornell 604] from the National *Sclerotinia* trial had lower white mold ratings but produced disappointing yields (<26 cwt). The best entry was MSU black line B05055. Past experience using low yielding resistant germplasm as parents has not proved useful in breeding for white mold resistance. Overall the trial confirmed results from previous years and this trial will continue to be a vital part of the breeding effort to improve tolerance to white mold in dry beans.

**Expts. 7215, 7216, 7221: White Mold Genetic Yield Trials**

Two 96-entry trials were conducted at Montcalm to evaluate the genetic resistance to white mold in two recombinant inbred line (RIL) pinto populations [AP647 and AP630] developed from the crosses: AN 37/P02647 [test 7215] and AN 37/P02630 [test 7216]. A third 24-entry study [test 7221] included extra entries from the same crosses that could not be included in the two larger experiments. Crosses were made to introduce white mold resistance from AN 37 into the two upright pinto lines P02630 and P02647 from the MSU program. Natural white mold infection occurred across the entire trial and was extremely severe in certain plots, and ranged from 11 to 94% (test 7215); 11-89% (test 7216); 17 to 83% (test 7221). There did not appear to be an association between % white mold and yield. Test 7215 ranged in yield from 26 to 42 cwt/acre with a mean yield of 34 cwt/acre. Variability was high due to white mold pressure, only 2-reps experiment (CV=11.5%), so a high LSD value (7.7 cwt/acre) was needed for significance and only one line significantly outyielded the test mean. Test 7216 ranged in yield from 29 to 46 cwt/acre with a mean yield of 37 cwt/acre. Variability was high due to white mold pressure, only 2-reps experiment (CV=10.4%), so a high LSD value (7.7 cwt/acre) was needed for significance and only two lines significantly outyielded the test mean. Test 7221 ranged in yield from 26 to 44 cwt/acre with a mean yield of 34 cwt/acre. Variability was high due to white mold pressure, only 2-reps experiment (CV=12.4%), so a high LSD value (8.4 cwt/acre) was needed for significance and only one line significantly outyielded the test mean. Overall yields were highest in test 7216 and this population was chosen for more in-depth study. A genetic mapping experiment to find markers associated with white mold resistance in this population will be initiated. Elite lines from all three tests will be included in pinto bean yield tests in 2008.

**Expts. 7817, 7818, 7919, 7920: Organic Dry Bean Yield Trials, KBS & Gratiot County**

Four 16-entry trials were conducted in certified organic fields at KBS and in commercial grower's fields near Alma in Gratiot County with the primary focus of identifying different bean genotypes with better adaptation to the organic production system. For control purposes an exact experiment was planted in an adjacent field using standard conventional practices of fertilization, chemical weed and insect controls. Severe early drought damaged trial at KBS and resulted in regrowth and increased variation. Growing conditions were generally favorable in Alma in 2007 with good harvest conditions in the fall. KSB experiment (tests 7817A & 7818A) and Alma experiment (tests 7919A & 7920A) consisted of small-seeded black and navy bean genotypes that included a non-nodulating genotype and an ineffective nodulating genotype derived from Bunsi/Ex Rico. These genotypes were included to estimate the level of nitrogen-fixation in the standard genotypes in the organic trial where no artificial fertilizer was added. The second experiment (tests 7817B & 7818B – KBS; 7919B & 7920B -Alma) consisted of 16 large-seeded genotypes that included pinto, pink, small red, great northern, cranberry and kidney seed types. Yield in tests7817A & 7818A ranged from 5 to 22 cwt/acre with a mean yield of 18 cwt/acre in the organic, compared to 14 to 25 cwt/acre with a mean yield of 20 cwt/acre in the conventional treatment. Variability was high in both tests ranged (CV=18.6%) resulting in LSD values (4.7 and 5.2 cwt/acre) needed for significance. Yield in tests7919A & 7920A ranged from 5 to 20 cwt/acre with a mean yield of 16 cwt/acre in the organic, compared to 10 to 19 cwt/acre with a mean yield of 16 cwt/acre in the conventional treatment. Variability was high in both tests ranged (CV=17.5 - 16%) resulting in LSD values (4.0 and 3.5 cwt/acre) needed for significance. As a result no entry exceeded the test mean for either experiment. Overall means showed no difference between treatments but individual genotypes differed. Greater range in yield was observed in the organic treatment. The lowest yielding entries in both treatments were the non-nod types. As expected, yields were significantly lower in the organic treatment indicating that fertility was limiting. The normal varieties appeared to compensate for lower fertility through N-fixation and overall higher yields were observed in the organic treatment.

Yield in tests7817B & 7819B ranged from 11 to 17 cwt/acre with a mean yield of 14 cwt/acre in the organic, compared to 9 to 23 cwt/acre with a mean yield of 13 cwt/acre in the conventional treatment. Variability was high in both tests (CV=23-25%) resulting in LSD values (4.9 and 4.4 cwt/acre) needed for significance. Yield in tests7919B & 7920B ranged from 7 to 22 cwt/acre with a mean yield of 15 cwt/acre in the organic, compared to 7 to 25 cwt/acre with a mean yield of 16 cwt/acre in the conventional treatment. Variability was high in both tests (CV=20.3%) resulting in LSD values (4.3 and 4.7 cwt/acre) needed for significance. A negative value in the difference column for yield and seed size in both experiments indicates lower values in the organic treatment and a positive value indicates lower values in the conventional treatment. Large differences in yield were observed between treatments at KBS and were due in part to regrowth in specific plots rather than to the treatment effect. Four lines significantly exceeded the test mean in the organic versus five lines under conventional in Alma. Merlot, Buster and P06131 exceeded the mean in both treatments. Overall slightly lower yields were observed in the organic but significantly lower yields for Buster, Othello, P06131 and P04205 pintos, Capri and Matterhorn were observed in the organic treatment. Plans exist to continue this experiment in 2008 to verify genotypic response to the different treatments. The traditional county trial in northern Michigan was discontinued in 2007 due to a lack of interest.

**Early Generation Breeding Material grown in Michigan in 2007**

**F3 through F5 lines**

Navy and Black - 485 lines
Pinto - 440 lines
GN - 229 lines
Pinks and Reds - 250 lines
Kidneys (DR, LR, White) - 277 lines
Cranberry (bush, vine) - 58 lines
Yellow Eye – 4 lines

**F2 populations**

Navy and Black -125 populations
Pinto - 104 populations
GN - 23 populations
Pinks and Reds - 90 populations
Kidneys (DR, LR, White) – 106 populations
Cranberry (bush, vine) – 26 populations
Yellow Eye - 4 populations
Flor de Mayo – 49 populations

**F1 populations:** 742 different crosses among seven contrasting seed types.