2008 DRY BEAN YIELD TRIALS

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Twenty-seven yield trials were conducted in 2008 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, 15 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 (over 3,800 plots) 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. These included 30-entry navy test; 36-entry standard black test; 20-entry navy and black prelim test; three GN tests with 30, 42, and 42 entries; three pinto tests with 42, 64, and 56 entries; three red/pink tests with 20, 36, and 56 entries; Otebo test with 3 lines with BCMV resistance and 9 small GN's; 42-entry coop and regional test that includes pinto, GN, red and pinks; 9-entry vine, and two bush cranberry tests with 30 and 36 entries; four kidney tests with 42, 64, 64, and 9 entries; two white mold tests one with 64-entries and one 96-entry pinto trial; two certified organic trials one 32-entry test at KBS and second 32-entry test in Gratiot county; two PLH observation trials one 32-entry test on campus and second 32-entry test at the Montcalm Research farm. All trials except for kidney, cranberry and white mold, organic, and PLH were direct harvested. 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.

Plots in Saginaw had one of the most severe epidemics of common bacterial blight (CBB) in years due to high rainfall in June/July. As a result the program was able to identify high levels of resistance in black, navy, pinto, red and great northern market classes. With few exceptions the highest-yielding entries in all tests had the highest levels of CBB resistance. Yields averaged 22 cwt/acre and the best lines exceeded 31 cwt/acre, but yields were overall lower in the earlier season pinto, great northern, red and pink beans. Higher temperatures and lower rainfall limited the spread of white mold despite access to irrigation at Montcalm. Rainfall (June-September) averaged 10.42" at Montcalm with only 0.6" in June and under 2" during July and August with an excess of 7.00" in September. Overall trails at Montcalm were excellent in 2008 and yields were high, exceeding 41 cwt/acre in kidney tests and 53 cwt/acre in the white mold test, where the overall mean yield exceeded 39 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 and at KBS suffered severe drought at the both sites in July that resulted in low yields and 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 poultry 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. 8101: Standard Navy Bean Yield Trial

This 30-entry trial included standard commercial navy bean varieties, and advanced lines from the MSU breeding program, which carry the N-prefix. Yields ranged from 6.5 to 25.8 cwt/acre with a mean of 17.2 cwt/acre. The trial was fairly uniform but variability was high (CV=15%) and the LSD needed for significance was 3.7 cwt/acre. Three entries significantly out-yielded the test mean and included N05319 which exhibited high levels of resistance to CBB. N05319 ranked 1st in 2006. N05324 which had ranked 1st and 2nd in last two years dropped to 21st in this test due to susceptibility to CBB. All check varieties T9905, Avalanche, Lightning, Vista, Seahawk and Mayflower ranked below the mean.

Expt. 8102: Standard Black Bean Yield Trial

This 36-entry trial included the standard commercial black bean varieties and advanced breeding lines. Yields ranged from 16 to 31 cwt/acre with a test mean of 22 cwt/acre. Variability was moderate in this test, (CV=11.5%) and the LSD was 3.6 cwt/acre. Six breeding lines significantly out-yielded the test mean and included only those lines with CBB resistance. Shania was highest yielding varieties followed by Domino, Zorro, Black Velvet, Condor and Jaguar. 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.

Expt. 8103: Preliminary Black & Navy Bean Yield Trial

This 20-trial included new black and navy bean liens along with check varieties. Yields ranged from 17 to 32 cwt/acre with a mean of 23 cwt/acre. Variability was not well controlled in this 3-rep test (CV=12.5%) despite being direct harvested and the LSD was 4.7 cwt/acre resulting in only 3 lines that significantly outyielded the test mean. The top yielding entries included B05055 (as in test 8102) along with a reselection of the same line. A new navy line N08007 ranked 1st producing 2.6 cwt/acre more than the 2nd entry. A reselection of Zorro ranked 4th. Clearly resistance to CBB was a major factor in this test and a number of new lines showed good levels of resistance along with acceptable yield potential.

Expt. 8104: Standard Great Northern Bean Yield Trial

This 30-entry trial included MSU great northern breeding lines and standard commercial check varieties. The test ranged in yield from 14 to 23 cwt/acre with a mean yield of 18 cwt/acre. Variability was high (CV= 13.9%) resulting in a high LSD value (3.6 cwt/acre) needed for significance. Only one breeding line G07302 significantly outperformed the test mean. This line ranked 2nd in 2007 and has upright architecture as reflected in a high DS score. Two older lines G05239 and G05220 that were 1st and 3rd in 2007 were also in the top group along with Matterhorn. The trial was direct harvested when the plants were very dry resulting in higher shattering and seed splitting, and probable lower yields. Only those entries with larger seed size, improved dry seed quality and cracking resistance over Matterhorn will be advanced in 2009.

Expt. 8105: Standard Pinto Bean Yield Trial

This 42-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 12.6 to 24.7 cwt/acre with a mean of 20 cwt/acre. There was greater variability (CV=11.7%) in this trial than in past years and the LSD needed for significance was 3.3 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. Two sister liens with CBB resistance were the top entries and the 3rd line P07863 was the highest yielding pinto in the white mold trials in Montcalm in 2007 and 2008. Other lines from the same cross exceeded the test mean, whereas a few were among the lowest yielding. New varieties Stampede, Lariat and Santa Fe yielded above the test mean, whereas the prostrate varieties Buster and Othello were among the lowest yielding. Three entries from USDA-WA performed above the test mean. Only those entries with more upright architecture and equivalent canning quality to Othello will be advanced in 2009.

Expt. 8106: Standard Pink and Small Red Bean Yield Trial

This 20-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 14 to 27 cwt/acre with a mean yield of 19 cwt/acre. Variability was high (CV=14.4%) due to direct harvesting resulting in a LSD value (3.8 cwt/acre) for significance. Four lines significantly outperformed the test mean and three red lines (R06-prefix) represented the same family as in 2007. These lines showed high levels of resistance to CBB but lacked the seed quality of Merlot. 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. The one pink line S07501 continues to show potential and appears to possess partial resistance to CBB. Check varieties such as Brooks, Merlot, and Sedona were equal to or lower than the test mean. All varieties were lower yielding due to the high incidence of CBB in the plots. Reselections were made in Merlot in 2007 to remove the late maturing plants and the reselected line was similar to Merlot in yield and phenotype. Only those small red entries equivalent to Merlot and pink lines equivalent to Sedona in canning quality will be advanced in 2009.

Expt. 8107: Standard Tebo Bean Yield Trial

This 12-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' sweet bean paste. Included in the test are fourth backcross (BC4; G05-Prefix) lines similar to Tebo with resistance to BCMV. Virus resistance came from Matterhorn parent and was backcrossed to the Hime Tebo parent to recover Tebo plant and seed type. The test ranged in yield from 12 to 22 cwt/acre with a mean yield of 17 cwt/acre. Variability was very high (CV=18.9%) resulting in a LSD value (4.4 cwt/acre) for significance, so only two lines significantly outperformed the test mean. Fuji, previous code G05922 that ranked 1st in 2007 and 2nd in 2006 was at the bottom of the test. The trial was direct harvested which may have resulted in more seed loss in these short stature bush beans, but the CBB infection severely damaged the two G05-lines. The high incidence of CBB in the trial may have contributed to lower yields and increased variability in this

test. Included in the test was a group of sister lines from a cross between an upright navy and two great northern bean. These lines are indeterminate, more upright than the bush tebo and have a seed size similar to tebo. Two of these lines show excellent yield potential and upright architecture based on high DS scores. A select group of the highest-yielding lines will be evaluated for their suitability in making sweet bean paste and any decision on lines to advance will depend on those results.

Expt. 8108: Preliminary-PYT1 Great Northern Bean Yield Trial

This 42-entry trial includes new MSU great northern breeding lines (G08-prefix) and standard commercial check varieties. The test ranged in yield from 14 to 26 cwt/acre with a mean yield of 21 cwt/acre. Variability was high (CV= 11.5%) resulting in a high LSD value (4 cwt/acre) needed for significance. Only one breeding line G08243 significantly outperformed the test mean. The 2nd line G08217 has improved upright architecture as reflected in a high DS=6.4 score (Matterhorn=4). The trial was direct harvested when the plants were very dry resulting in higher shattering and seed splitting, and probable lower yields. However, yields were higher that those in test 8104 (harvested on same day) as Matterhorn yielded >2cwt/acre in this test. Only those entries with larger seed size, improved dry seed quality and cracking resistance over Matterhorn will be advanced in 2009.

Expt. 8109: Preliminary-PYT2 Great Northern Bean Yield Trial

This 42-entry trial includes new MSU great northern breeding lines (G08-prefix) and standard commercial check varieties. The test ranged in yield from 23 to 31 cwt/acre with a mean yield of 26 cwt/acre. Variability was high (CV= 11.3%) resulting in a high LSD value (4.8 cwt/acre) needed for significance. No breeding lines significantly outperformed the test mean. The trial was direct harvested following a 1" rain, so there was less shattering and seed splitting than in tests 8104 and 8108. The yields were higher that those in test 8109 as Matterhorn yielded >2cwt/acre in this test. Only those entries with high yield potential, improved dry seed quality and cracking resistance over Matterhorn will be advanced in 2009.

Expt. 8110: Preliminary-PYT1 Pinto Bean Yield Trial

This 64-entry trial includes new MSU pinto bean breeding lines (P08-prefix) and standard commercial check varieties. The trial ranged in yield from 14 to 26 cwt/acre with a mean of 19 cwt/acre. There was greater variability (CV=23.6%) in this trial than in past years and the LSD needed for significance was 7.5 cwt/acre. No breeding lines significantly outperformed the test mean, but P08339 yielded 1.4 cwt/acre above the next entry. The trial was direct harvested following a 1" rain, so there was less shattering and seed splitting than in tests 8104 and 8108. La Paz was among the highest yielding variety followed by Santa Fe at <3cwt/acre less. Only those entries with more upright architecture and equivalent canning quality to Othello will be advanced in 2009.

Expt. 8111: Preliminary-PYT2 Pinto Bean Yield Trial

This 56-entry trial includes new MSU pinto bean breeding lines (P08-prefix) and standard commercial check varieties. The trial ranged in yield from 13 to 27 cwt/acre with a mean of 21 cwt/acre. There was greater variability (CV=15.2%) in this trial than in past years and the LSD needed for significance was 5.2 cwt/acre. Five breeding lines significantly outperformed the test

mean including La Paz variety. The trial was direct harvested when the plants were very dry resulting in higher shattering and seed splitting, and probable lower yields, but yields were higher that those in test 8105. Santa Fe was below the test mean. Only those entries with more upright architecture and equivalent canning quality to Othello will be advanced in 2009.

Expt. 8112: Preliminary-PYT1 Pink and Small Red Bean Yield Trial

This 36-entry trial includes new MSU pink (S08-prefix) and small red (R08-prefix) bean breeding lines and standard commercial check varieties. The trial ranged in yield from 7 to 25 cwt/acre with a mean of 17 cwt/acre. There was greater variability (CV=23.4%) in this trial than in past years and the LSD needed for significance was 6.5 cwt/acre. Four breeding lines significantly outperformed the test mean including two sister lines (pink & red) that possess CBB resistance. The two selections from Merlot and Sedona performed better than original varieties. Merlot was above the test mean but Sedona was below the test mean. Only those entries with more upright architecture and equivalent canning quality to either Merlot or Sedona will be advanced in 2009.

Expt. 8113: Preliminary-PYT2 Pink and Small Red Bean Yield Trial

This 56-entry trial includes new MSU pink (S08-prefix) and small red (R08-prefix) bean breeding lines and standard commercial check varieties. The trial ranged in yield from 7 to 25 cwt/acre with a mean of 18 cwt/acre. There was greater variability (CV=16.7%) in this trial than in past years and the LSD needed for significance was 4.8 cwt/acre. Thirteen breeding lines significantly outperformed the test mean including Merlot. Within this group 11 were pink lines and only one was small red suggesting that higher yield potential residues in pink seed class. Sedona performed better ~ 5 cwt/acre than in test 8112. Only those entries with more upright architecture and equivalent canning quality to either Merlot or Sedona will be advanced in 2009.

Expt. 8114: Combined Midwest Regional Performance Nursery (MRPN) & Cooperative Dry Bean Nursery (CDBN) Yield Trial

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 42-entry trial ranged in yield from 9 to 27 cwt/acre with a mean of 19 cwt/acre. Variability was high (CV=13.7%) resulting in a LSD value (4.2 cwt/acre) for significance. As a result only seven lines were significantly higher in yield than the test mean. The top yielding entries were all pintos included Kimberly variety. The 2nd entry P07863 was the top yielding entry in the white mold trials in 2007 and 2008. The group included two other MSU lines P07405 and P06131, decumbent line CO 55658 from Colorado, and an erect pinto PT 7-1 from USWA. Nine check varieties, including Santa Fe, Matterhorn, Buster and Othello yielding below the test mean. The exceptions were the two new varieties Stampede and Lariat and decumbent variety, Sawtooth 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. 8115: Standard Vine Cranberry Bean Yield Trial

This 9-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 C05-, C06-), bush cranberry variety Capri and the check was the vine cranberry variety Chianti. Yields ranged from 17 to 24 cwt/acre with a mean of 21 cwt/acre. Variability was modest in this test (CV=9.4%) as the trial was pulled, and LSD value of 2.7 cwt/acre was needed for significance. Only two lines significantly outyielded the test mean and included the Chianti check. The top entry C06808 with a more upright habit and larger seed (56g) showed the best potential in 2008 and 2007. 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, Micran, T. Hort and new line C07403 performed poorly and the mediocre performance raises concerns over their future potential. C05625, the top-yielding entry in Montcalm in 2006, ranked 6th in 2007 and was 4th in this test behind Capri. Only those entries with equivalent canning quality to Micran will be advanced in 2009.

Expt. 8216: Standard Bush Cranberry Bean Yield Trial

This 30-entry trial was conducted on the Montcalm Research Farm to compare new and standard bush cranberry bean varieties under supplemental irrigation. Yields ranged from 17 to 39 cwt/acre with a mean of 27 cwt/acre. Variability was high (CV=15%) in this test and the LSD needed for significance was high (5.7 cwt/acre). Only three lines significantly outyielded the test mean and these included the new breeding line C07412 and USCR-CBB-19 & 20 lines from USWA suggesting that higher levels of resistance to CBB is contributing to yield. There was a 4 cwt difference in yield between the 3rd and 4th entries and Capri ranked 5th. The best new MSU entry C07403 in 2007 ranked 8th in 2008. Check varieties, Hooter, T. Hort and Cardinal all yielded below the test mean. Only those entries equivalent to Capri in seed size and canning quality will be advanced in 2009.

Expt. 8217: Preliminary Bush Cranberry Bean Yield Trial

This 36-entry trial was conducted on the Montcalm Research Farm to compare new bush cranberry bean varieties under supplemental irrigation. Yields ranged from 2 to 33 cwt/acre with a mean of 24 cwt/acre. Variability was moderate (CV=8.6%) in this test and the LSD needed for significance was 3.3 cwt/acre. Fourteen lines significantly outyielded the test mean and these included the new breeding lines that originated from the same cross. Those with seed size <55 g will be discarded. Capri yielded above the test mean. A group of yellow beans (code FR-prefix) were low yielding well below the test mean. A few were not adapted yielding less than 10 cwt/acre. Only those entries equivalent to Capri in seed size and canning quality will be advanced in 2009.

Expt. 8218: Standard Kidney Bean Yield Trial

This 42-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 (8x total 5.25”). Yields ranged from 6 to 41 cwt/acre with a mean of 33 cwt/acre. Variability was high (CV=12.4%) resulting in a large LSD value (5.7 cwt/acre) needed for significance. Five entries significantly outyielded the test mean

and these included varieties Chinook and Montcalm and three new DRK lines K06001 and sister lines K06011 and K06012. The later cross is among the top yielding lines. Chinook Select ranked 1st and outperformed Chinook 2000 in 2008 as in 2007. Other checks, CELRK, Redcoat and new varieties Lyrik and Blush were lower yielding and fell below the test mean. The new CBB resistant line (CBB-15) including Red Hawk and Beluga were above the test mean. 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 2009.

Expt. 8219: 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 (K08-prefix), under supplemental irrigation at the Montcalm Research Farm. Yields ranged from 18 to 39 cwt/acre with a mean of 28 cwt/acre. Variability was very high (CV=15.4%) resulting in a large LSD value (7cwt/acre) needed for significance. Four DRK sister lines significantly outyielded the test mean and many of the entries in this test exhibited good levels of CBB resistance. Seed size varied from under 50 g to over 73 g. All entries will be canned prior to advance in 2009.

Expt. 8220: Preliminary White Kidney Bean Yield Trial

This 64-entry trial was conducted to compare the performance of new white kidney lines (K08-prefix) with CBB resistance, under supplemental irrigation at the Montcalm Research Farm. Yields ranged from 15 to 47 cwt/acre with a mean of 38 cwt/acre. Variability was moderate (CV=8.8%) resulting in a large LSD value (5.5 cwt/acre) needed for significance. Seven lines significantly outyielded the test mean and many of the entries in this test exhibited good levels of CBB resistance. Seed size ranged from under 50 g to 98 g (fabada types). All entries will be canned prior to advance in 2009.

Expt. 8221: Standard White Kidney Bean Yield Trial

This 9-entry trial was conducted to compare the performance and canning quality of older white kidney lines, under supplemental irrigation at the Montcalm Research Farm. Yields ranged from 23 to 33 cwt/acre with a mean of 28 cwt/acre. Variability was moderate (CV=7.6%) resulting in LSD value (3.5 cwt/acre) needed for significance. Only one line K04607 significantly outyielded the test mean and Beluga and most of the entries were low yielding compared to lines in test 8220. Seed size and canning quality will influence lines that will be advanced in 2009.

Expt. 8222: 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* Initative (NSI) Nursery. 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 8.4" 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 20 to 67% and pressure was lower than in past years. The test ranged in yield from 15 to 54 cwt/acre with a mean yield of 39 cwt/acre. Variability was moderate (CV=9.9%), thus a high LSD value (6.4 cwt/acre) was needed for significance. Despite the variability, 13 lines significantly outyielded the test mean and the results are similar to data collected in 2006 and 2007. Two black lines B05055 and B04316 exceeded 50 cwt/acre were among the top entries in 2008 and had previously topped trials in 2006 and 2007. Both black lines exhibited CBB resistance and continued to grow when other entries had succumbed to disease. Top entry was pinto line P07863 that was the top yielder in 2007 was entered in NSI trial and this line continues to demonstrate superior yield performance under white mold pressure. Two other pinto lines P07757 and P07751 that ranked 1st and 2nd in test 7215 in 2007 also showed excellent potential by exceeding 50 cwt/acre in 2008. One of the highest yielding entry B07104 in past years was entered in NSI and ranked 15th in this trial. This line 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. One of the black lines in the top group in 2007 was B03622 that topped yield trial in Saginaw in 2006 and ranked 5th in 2008 but has been inconsistent in yield. The reselected Merlot exceeded yield of Merlot by 4cwt/acre. Only Santa Fe, Merlot and Condor exceeded the test mean. Among the MSU varieties that produced disappointing yields below the test mean were Zorro, Jaguar, Sedona, Matterhorn and Bunsi. Beryl, Orion and Fuji had the highest mold ratings (60%) with corresponding low yields. Seven entries from NSI trial were among 10-lowest yielding lines. Past experience using low-yielding white mold 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.

Expt. 8223: White Mold Genetic Yield Trial

A 4-replicate 96-entry trial was conducted at Montcalm to evaluate the genetic resistance to white mold in the recombinant inbred line (RIL) pinto population AP630 developed from the cross of AN 37/P02630. Cross was made to introduce white mold resistance from AN 37 into the upright pinto line P02630 from the MSU program. Natural white mold infection occurred across the entire trial and ranged from 12 to 36% so disease pressure was low despite 13 irrigations to promote disease development. The test ranged in yield from 30 to 52 cwt/acre with a mean yield of 40 cwt/acre. Variability was moderate (CV=9.7%), and a LSD value (5.5 cwt/acre) was needed for significance. Despite the variability, six lines significantly outyielded the test mean and the results are similar to data collected in 2007. Top entry was pinto line P07863 that was the top yielder in 2007 and in test 8222 and this line continues to demonstrate superior yield performance under white mold pressure. Two other lines P07839 and P07901that ranked 3rd and 4th in 2007 were among the top six entries in 2008. The two parents yielded below the test mean and many of the lowest yielding entries were similar in both years. A genetic mapping experiment to find markers associated with white mold resistance in this population will be initiated. Elite lines will be included in standard pinto bean yield tests in 2009.

Expts. 8241-8242: Leafhopper Screening Trials

Two 16-entry trials were conducted in Montcalm to determine the reaction of diverse group of genotypes to natural infections by potato leaf hopper (PLH). Both trial locations were planted near alfalfa fields which are usually a source of insects particularly following second cutting. PLH population incidence was monitored to determine whether PLH preferences exist between the difference genotypes. By monitoring the differences in the number of PLH nymph numbers, inferences can be made as to oviposition (egg-laying) and feeding preferences of the PLH insects. No insecticide was applied to this nursery and the numbers of PLH nymphs were counted on two separate occasions prior to flowering. The yield in test 8241 small-seeded entries ranged from 18 to 41 cwt/acre with a mean of 32 cwt/acre. Variability was moderate (CV=7.6%), the LSD was 4.0 resulting in five lines that significantly exceeded test mean. This group was 4 cwt/acre above next entries. The top-yielding entries B05055, B04316 and Zorro were the same two black lines that topped prior tests in Montcalm. Among the small-seeded entries, the black bean Raven had the lowest PLH nymph counts in each trial location. The yield in test 8242 large-seeded entries ranged from 23 to 36 cwt/acre with a mean of 30 cwt/acre. Variability was moderate (CV=11.2%), the LSD was 5.5 resulting in only Merlot significantly exceeded test mean.

Expts. 8443-8444: Leafhopper Screening Trials

Two 16-entry trials were conducted in East Lansing to determine the reaction of diverse group of genotypes to natural infections by PLH. Both trial locations were planted near alfalfa fields which are usually a source of insects particularly following second cutting. PLH population incidence was monitored to determine whether PLH preferences exist between the difference genotypes. By monitoring the differences in the number of PLH nymph numbers, inferences can be made as to oviposition (egg-laying) and feeding preferences of the PLH insects. No insecticide was applied to this nursery and the numbers of PLH nymphs were counted on two separate occasions prior to flowering. The yield in test 8443 small-seeded entries ranged from 17 to 37 cwt/acre with a mean of 31 cwt/acre. Variability was high (CV=15.9%), the LSD was 8.0 so no lines significantly exceeded test mean. The yield in test 8444 large-seeded entries ranged from 23 to 42 cwt/acre with a mean of 33 cwt/acre. Variability was moderate (CV=7.8%), the LSD was 4.2 resulting in five lines that significantly exceeded test mean. These included Matterhorn and Merlot and two pinto Sierra and Aztec and they had lower overall PLH counts within the large-seeded entries while still having higher than average yields. Large-seeded genotypes generally had consistently higher PLH counts than small-seeded genotypes in each trial location. Specifically, the kidney varieties K03240, Montcalm and Beluga consistently had the highest numbers of leafhopper nymphs present across field trial locations indicating susceptibility to the pest. Plans are underway to continue this research in 2009.

Expts. 8831, 8832, 8833, 8834, 8935, 8936, 8937, 8938: Organic Dry Bean Yield Trials, KBS & Gratiot County

Sixteen small-seeded and 16 large-seeded genotypes were evaluated for their performance in an organic production system. Side by side, organic and conventional, plots were planted in fields at Kellogg Biological Station (KBS), Kalamazoo County (Expts. 8831, 8832, 8833, 8834) and also in a commercial grower's fields in Gratiot County near Alma (Expts. 8935, 8936, 8937, 8938). Organic plots were planted in certified organic fields whereas conventional plots planted on adjacent non

certified land served as a control. Organic plots and conventional plots were identical in layout and genotypes included. Organic plots were managed using approved organic methods while traditional practices were followed on conventional plots. Rainfall at both locations was inconsistent resulting in reduced yields and increased variation. Severe weed pressure in the organic plot (Expts. 8831 and 8833) at KBS further contributed to variation at that site. Small-seeded genotypes included navy and black beans along with a stress resistant line, TARS with shiny red seeds (Expts. 8831, 8833, 8935, 8937). A non-nodulating genotype, R99, derived from the navy Bunsi/Ex Rico, was included to estimate the level of nitrogen fixation of other genotypes in the study. The large seeded genotypes represented pinto, pink, small red, great northern, cranberry and kidney seed types (Expts. 8832, 8834, 8936, 8938). Yield for the small seeded at KBS ranged from 9.1 cwt/acre to 16.1 cwt/acre for the organic experiment while the conventional had a higher yield, with a range of 10.2 cwt/acre to 21.6 cwt/acre. The mean for organic was 12.7 cwt/acre with a mean of 17.9 for the conventional plot. There was considerable variability resulting in LSD values of 3.8 and 4.8 respectively.
The large-seeded organic experiment at KBS yielded less than the conventional. The average yield for the organic plots was 12.4 cwt/acre compared to 16.6 cwt/acre in conventional. There was considerable range in yield in each test, ranging from 8.3 cwt/acre to 15.4 cwt/acre for organic with the range from 12.5 cwt/acre to 20.2 cwt/acre for the conventional. None of the small seeded genotypes yielded significantly different than the mean, however Buster yielded significantly greater than the mean (P=0.05, LSD =3.0) in the organic trial at KBS (Expt. 8832), whereas Matterhorn yielded significantly better in the conventional test (Expt. 8834) than the mean (P=0.05, LSD=3.4). Yield was lower in the organic plots than conventional plots indicating that nutrients were a limiting factor.

In Gratiot County, small seeded genotypes in the organic plots had a range of 1.6 cwt/acre to 10.4 cwt/acre compared to a range of 7.8 cwt/acre to 19.4cwt/acre in the conventional plot. As expected the non-nodulating genotype, R99, was the lowest yielder in both organic and conventional tests. The range for large seeded genotypes in the organic plots was 6.1 cwt/acre to 19.0 cwt/acre. Variation was greatest in the organic plots, with a CV of 25.1%. In conventional plots yield of large seeded genotypes ranged from 7.9 cwt/acre to 22.4 cwt/acre. Variation was greater for the organic plots (CV=21.3% versus CV=14.1% for conventional). Both Jaguar and 115M black lines yielded significantly better than the mean in the organic plots (P=0.05, LSD=2.6). The newly released black bean Zorro significantly exceeded the average yield in the conventional plots (P=0.05, LSD=3.7). Large seeded genotypes, Sedona, Merlot and pinto P06131, yielded significantly greater than the means in both organic and conventional plots (P=0.05, LSD=3.2 and 2.6 respectively). In the conventional plots, Buster also yielded significantly greater than the test mean (P=0.05, LSD=2.6).

Early Generation Breeding Material grown in Michigan in 2008

F3 through F5 lines

Navy and Black - 640 lines
Pinto - 665 lines
GN - 371 lines
Pinks and Reds - 216 lines
Kidneys (DR, LR, White) - 380 lines
Cranberry (bush, vine) - 144 lines
Yellow Eye – 21 lines
Flor De Mayo – 127 lines

F2 populations

Navy and Black -314 populations
Pinto - 150 populations
GN - 103 populations
Pinks and Reds - 90 populations
Kidneys (DR, LR, White) – 87 populations
Cranberry (bush, vine) – 100 populations
Tebo – 23 populations

F1 populations: 862 different crosses among seven contrasting seed types.