Jose Fernandez Memorial Chair of Crop Production
Annual Report (July 1, 2015 – June 30, 2016)
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Onion Cultivar Development

Open-pollinated, male-sterile, maintainer, and pollinator breeding lines were screened for disease resistance, bulb yield, bulb quality, maturity date, and bulb color. Promising breeding and hybrid lines and released cultivars were compared to commercial cultivars and experimental lines using observational trials. An autumn-sown and a winter-sown observational trial were conducted on a local grower's field. 'NuMex Quasar' was released. It is an open-pollinated, early-maturing, bolting-resistant, short-day cultivar with white-colored dry outer scales. It matures in late May to early June when autumn-sown in southern New Mexico. This cultivar will satisfy a need for a white onion cultivar that matures at this time. One hundred and eleven selections of different lines were conducted this year. Seeds of 213 different lines were produced this year.

Fusarium Basal Rot Research

Seed of original, intermediate, and advanced Fusarium basal rot (FBR)-selected populations and one resistant and one susceptible check were sown in fields at the Leyendecker Plant Science Center in Las Cruces, NM in October 2015. There were a total of 32 entries that were replicated four times. In April 2016, cultures of *Fusarium oxysporum* f. sp. *cepae* isolate CSC 515 were initiated from infected barley seeds. Onion bulbs were inoculated with mycelium and spores from these cultures. The pathogen was reisolated from infected basal plate tissues of these inoculated bulbs. Infected bulbs served as an inoculum source for generating fresh inoculum and to maintain pathogen virulence. Small sections of infested basal plate tissue were placed on petri plates of potato dextrose agar (PDA) to encourage pathogen growth. Fungal spores were rinsed from these plates with distilled water and mixed with cooled, autoclaved PDA media to result in a final spore concentration of 3×10^5 spores$\bullet$ml^{-1} of PDA in the poured plates. Starting in June, bulbs were harvested from the planted populations once plants had reached maturity. Basal plates of harvested bulbs were cut transversely and a 1 cm diameter plug of PDA inoculum was applied to the cut surface. This inoculation method was determined from research conducted in the previous year. Bulbs were placed in black plastic crates and crates were placed in black plastic bags for 1 day to encourage mycelium growth and infection. After 21 days from inoculation, the basal plate of each bulb will be cut again and the basal plate will be rated on a scale of 1-9 where a 1 represented no diseased tissue and a 9 represented 70% or more of the basal plate tissue was diseased. As of the date of this report, basal plates had not been rated yet. In addition to this research, another study was initiated to investigate the relationship between inoculum concentration and disease development, between basal plate preparation and disease development, and the interaction of time with these two factors as it relates to disease development. Decreasing inoculum spore concentration reduced the amount of disease development. In addition, an intact basal plate greatly reduced disease development as compared to a cut basal particularly as inoculum spore concentration decreased. Additional time may be needed for disease development when spore concentrations are low and/or the basal plate is left intact. The effect of time on disease development with respect to these two factors is currently being investigated.

In September 2015, bulbs selected from the first and second generation lines of all seven cultivars were placed into separate locations in a field at the Leyendecker Plant Science Research Center to produce seed of each line in the following year. In April, those bulbs produced seedstalks and began the flowering process. Crossing cages were constructed and placed over the flowering bulbs. In May 2016, pollinators (honeybees and blue bottle flies) were introduced into the cages to pollinate flowers. These pollinators remained in the cages for 3-4 additional weeks. In July 2016, seed capsules will be harvested and seed cleaning will be initiated. Once seed cleaning is finished, seed of these selected plants will be placed in on-farm grower trials in the autumn of 2016.

Onion Thrips and Iris Yellow Spot Research

During the summer of 2015, four advanced lines, NMSU 14-81, 14-208, 14-240, and 14-244, in addition to three commercial cultivars were evaluated for onion thrips and Iris yellow spot (IYS) resistance at the Malheur Experiment Station in Ontario, OR. Using standard commercial practices for thrips management, NMSU 14-81, 14-208 and 14-240 had much lower numbers of thrips than the commercial cultivars, especially through the peak time of thrips abundance in late June and July. All four experimental lines exhibited significantly less thrips feeding damage than the three commercial cultivars. NMSU 14-81, 14-208 and 14-240 had mean IYS damage ratings of 0.1 to 0.2, meaning that few plants had virus lesions, while the commercial cultivars had significantly greater amounts of damage, with mean IYS ratings ranging from 0.9 – 1.2. These same advanced lines were evaluated in a grower's field in Elba, NY using standard commercial practices for thrips management. Even though these lines were not well-adapted to growing in New York, plants of all four lines had fewer thrips over the growing season than the commercial cultivars, Bradley and Milestone.

During the summer of 2016, four advanced lines, NMSU 11-73, 14-79, 14-81, and 15-1018, in addition to a commercial cultivar were evaluated for onion thrips and IYS resistance at the Fabian Garcia Science Center. At five times throughout the growing season, plants of all four lines had fewer thrips than plants of the commercial cultivar. Early in the season, there were comparable numbers of thrips on plants of these lines that had not been sprayed with an insecticide and with plants that had been sprayed with a commercially-used insecticide for thrips control. Plants of all four lines exhibited a lower incidence (0.0-1.2%) of IYS than plants of the commercial cultivar (35%).

Onion Germplasm Regeneration and Maintenance

In November 2015, seed of 9 plant introduction (PI) accessions and 2 collected cultivars not currently in the collection was sent from the onion breeding program at NMSU to the onion curator at the PGRU in Geneva, NY. Regeneration attempts of 12 PI accessions and five collected germplasm lines were in progress during this year.

Outreach

On June 6, 2016, a field day was held to demonstrate the activities of the New Mexico State University onion breeding program. A presentation was given on the work being conducted to develop FBR-resistant cultivars.

Other

Our program continued to work with five minority students as interns with our program. Several of these interns were supported from funds from memorial chair. One intern continued his research project examining the effects of nepatalactone on the activity of onion thrips on onions. The intern and his research were supported through funding from the Cotter Work-Study Scholarship and the Howard Hughes Medical Institute Research Scholars Program. Our program employed two undergraduate genetics majors and two horticulture majors to gain valuable experience working with our research program. In an effort to further improve the efficiency of our breeding program, funds from the memorial chair were used to fabricate crossing cage covers that require less maintenance and have a greater lifespan than currently used fabric and to purchase a small plot vacuum seeder that reduced the need for hand planting of seeds. Funds were used to rent honeybee hives used in the seed production process and to pay for farm related charges associated with field preparation, crop management, and bulb harvest.

Publications

Refereed

Cramer, C.S. 2015. 'NuMex Allure' onion. HortScience 50:1735-1738.

Abstracts

Mandal, S. and C.S. Cramer. 2016. Selection progress for Fusarium basal rot resistance in onions, p. 22 . In: Proc. Graduate Research and Arts Symposium, Las Cruces, NM.

Rodriguez, D.H. and C.S. Cramer. 2016. The effect of *Nepeta cataria*'s essential oil on the onion pest *Thrips tabaci*. HHMI-Research Scholars Program Poster Presentation.

Rodriguez, D.H. and C.S. Cramer. 2016. The effect of *Nepeta cataria*'s essential oil on the onion pest *Thrips tabaci*. 21st Undergraduate Research and Creative Arts Symposium, Las Cruces, NM, p. 48.

Other

Cramer, C.S. 2015. 'NuMex Quasar' onion. NM Agric. Expt. Stn. Rel. Not., 15 pp.

Reitz, S.R., C.S. Cramer, C.C. Shock, E.B.G. Feibert, A. Rivera, and L. Saunders. 2015. Evaluation of new onion lines for resistance to onion thrips and *Iris yellow spot virus*. In: 2015 Malheur Experiment Station Annual Report.

Utilization of Memorial Chair Funds

$13,500.00 towards salary enhancement and fringe benefits of chair holder.
$9,499.59 towards undergraduate and graduate student salaries and fringe benefits.
$3,102.65 towards the purchase of a vacuum seeder.
$2,778.46 towards honeybee hive rental.
$2,500.00 towards tractor, irrigation and pesticide application charges.
$1,000.00 towards the purchase of new greenhouse benches for teaching greenhouses at the Fabian Garcia Science Center.
$591.32 towards the fabrication of crossing cage covers.
$525.62 towards the repair of implements used by the program.
$400.00 towards page charges associated with publishing a manuscript related to the research conducted as part of this endowed chair.
$348.84 towards mileage charges associated with the project vehicle.
$303.41 towards fuel associated with the project vehicle.

$140.35 towards other miscellaneous expenses.