

United States Department of Agriculture
Agricultural Research Service

RELEASE OF GREEN LEAF LETTUCE GERMPLASM WITH RESISTANCE TO
LEAFMINERS AND LETTUCE MOSAIC

The Agricultural Research Service, United States Department of Agriculture (USDA-ARS) announces the release of a breeding line of green leaf lettuce (*Lactuca sativa* L.) with resistance to leafminers (*Liriomyza langei* Frick) and lettuce mosaic. The line MU06-857 is similar to cultivar 'Lolla Rossa' ('Lollo Rossa') except it is larger and has green leaves. Green color extends close to the core on a partially trimmed head. Leaf margins are incised, indented, and undulated. Leaf surface is crinkled or blistered. Outer leaves are broader than long. Butt is flat, and ribs are flat but become more pointed toward the base. Bases of outer and interior leaves overlap well. Texture is relatively soft and flexible. Seeds are black. The line may be suitable for commercial production, and is suitable for use as sources of resistance to leafminers and lettuce mosaic in the development of cultivars and germplasm. It was developed at the United States Agricultural Research Station in Salinas, California by Beiquan Mou and Edward J. Ryder.

Worldwide, leafminers (*Liriomyza* spp.) are major insect pests of many important crops. Leafminer adults are small, shiny, black flies with a bright yellow triangular spot on the upper thorax between the wings. Leafminer damage occurs when adult flies puncture leaves to feed on plant sap and when females lay eggs within the leaf tissue, leaving "stings" that appear as holes or bumps on the leaves. Larvae hatch from the white, oval eggs and feed between upper and lower leaf surfaces, creating whitish, winding tunnels or mines. Damage caused by adult sting and larval mining reduces photosynthetic capacity, renders lettuce leaves unmarketable, and provides entrances for disease organisms. Chemical control of leafminers usually lasts only a short period of time. Adult control with contact insecticides is especially problematic because flies can easily move around and the treated field is subject to reinfestation from adjacent untreated crops and weeds. It has been well documented that leafminers can develop a high degree of resistance to a broad range of insecticides. Therefore, it is essential to develop alternative strategies for leafminer management, including the deployment of resistant varieties. Resistant varieties could reduce pesticide usage, which would benefit growers, consumers, and the environment. However, lettuce cultivars with a high level of resistance to leafminers are not currently available.

Lettuce mosaic virus (LMV) is a serious worldwide disease problem in lettuce. A susceptible plant exhibits systemic symptoms of vein clearing, mottling, leaf recurving, leaf margin frilling, distortion, stunting, and occasional necrosis. It is primarily transmitted by the green peach aphid (*Myzus persicae* Sulz.), and can cause losses of up to 100%. In California, the disease is generally controlled by the use of virus-free seeds in a seed certification program. In Europe, South America, and other lettuce-growing areas, lettuce mosaic is controlled through the use of resistant cultivars. Two recessive resistance genes, *mo-1^s* (*mo1¹*) and *mo-1^e* (*mo1²*), are incorporated in resistant cultivars in

Europe and in the United States, respectively, and have recently been cloned and sequenced.

The breeding line was derived from a cross between a crisphead cultivars 'Salinas 88' that has *mo-1^e* (*mo1²*) alleles, and a red leaf cultivar 'Lolla Rossa' that showed low leafminer sting density in previous screening experiments. The progeny plants were selected in the field of the USDA Agricultural Research Station in Salinas, CA for horticultural traits and lower sting density in summer when leafminers are abundant. Single plant selections were made by using the pedigree method of breeding from F₂ to F₆ generation, and MU06-857 is a F₇ breeding line.

To test the resistance of the breeding line to lettuce mosaic, 40 randomly selected seeds from MU06-857, resistant control 'Salinas 88', and susceptible control 'Glacier' and 'Misty Day' were sown in plastic pots and were germinated and grown in a greenhouse. Plants were inoculated with LMV at the three- to four-leaf stage. The tests were carried out twice. No plants from MU06-857 and resistant 'Salinas 88' developed any symptom, while all plants of the susceptible 'Glacier' and 'Misty Day' showed typical LMV symptoms.

MU06-857, along with commercial cultivars, was planted in trials at the Spence Farm of the USDA-ARS, Salinas, CA with four replications on June 28, 2006 and on June 19, 2007. Cultivar 'Lolla Rossa' was included in both trials as a resistant control. The breeding line had significantly lower leafminer sting density than the resistant control and commercial cultivars. MU06-857 had 43.1 and 52.8 stings per 20-cm² leaf area in 2006 and 2007, while 'Lolla Rossa' averaged 71.9 and 91.8 stings per 20-cm² in the two years, respectively. MU06-857 also had significantly higher plant weight and shorter core length than 'Lolla Rossa'. In the limited trials grown, the breeding line has performed well in the Salinas Valley, CA, producing a high percentage of plants of adequate size, shape, and uniformity. The adaptation of MU06-857 to other lettuce-growing regions and its resistance/susceptibility to other diseases or insects have not been evaluated.

Limited samples of seed are available for distribution to all interested parties for research purposes, including the development and commercialization of new cultivars. Samples will also be deposited in the National Plant Germplasm System. It is requested that appropriate recognition be made if the breeding line contributes to research or the development of new germplasm, breeding lines, or cultivars. Written requests should be sent to Dr. Beiquan Mou, USDA-ARS, 1636 E. Alisal St., Salinas, CA 93905.

Administrator, Agricultural Research Service

Date