Oenothera rosea: bringing wildflowers to yards as annuals and perennials

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EXECUTIVE SUMMARY

Oenothera rosea could be the newest species on the market! As a plant with both perennial and annual capabilities, this could bring a variety of new looks to the garden and yard. This plant exhibits beautiful color, that would be a lovely addition in any landscape. It naturally varies between a bright fuchsia pink, a light purply pink, and a light pink with white in the center. These very small dainty flowers show off these beautiful colors in an airy way. Dainty and airy are great descriptors for the look of this species. With very thin foliage and long stems, it captures a loose and wild look. In Figure 1, a pressed sample of the species flower and foliage is shown to depict the leaf shape and its size relation to the flowers. *Oenothera rosea* is a native to the warm southwestern areas of the United States and areas of Central and South America. This plant thrives the best as a perennial in similar warm areas. This plant could also be used as an annual in colder areas to increase marketability. The Oenothera genus is also a fast germinator. With untreated seeds, it was able to germinate in about 2 weeks and about a 65% germination rate. After germination, they grew their first true leaves and more within the next

few weeks. These proved to be fast growing plants with the promise of beautiful small accent flowers, and a great to any yard or garden



Figure 1: Herbarium or Pressed Sample of *Oenothera rosea* provided by the Lady Bird Johnson Wildflower Center

I. INTRODUCTION

A. Study Species.

This new crop species is called *Oenothera rosea.* This is a new flowering herbaceous “short lived” (Greiner, S., & Köhl, K., 2014) perennial or annual that is fresh to the market. Short lived refers to the fact that it often dies off within a few years, but will reseed. This species has many

dainty pink or purple flowers (Figure 2). The flower is small, only a few centimeters in diameter, as shown in scale with fingers in Figure 3. The foliage with small pinnate or lance shaped leaves (Figure 4), and a full sun sprawling growth habit. This species can provide beautiful color and ground cover in landscaping.



Figure 2: *Oenothera rosea* flower provided by the Lady Bird Johnson Wildflower Center



Figure 3: *Oenothera rosea* flower to scale

B. Taxonomic Classification and Geographic Distribution in the Wild.



Figure 4: *Oenothera rosea* flower and foliage provided by the Lady Bird Johnson Wildflower Center

Starting with taxonomy, *Oenothera rosea* is in the Onagraceae family, also known as the evening primrose family. This species goes by a few names like rose evening primrose, but plants in the oenothera genus have many names such as; pink evening primrose, showy evening primrose, mexican evening primrose, showy primrose, pink ladies, buttercups and pink buttercups (Lady Bird Johnson Wildflower Center).

This plant's genus, *Oenothera sp*. is native to the Southern and central United States

grassland as well as areas in South America. These states include Nebraska, Kansas, Missouri, Oklahoma, and Texas. This genus has also spread to other countries, becoming common in Europe as well (Mihulka, S et al. 2003). According to the Lady Bird Johnson Wildflower Center, *Oe. rosea*, is most found in Arizona, California, New Mexico and Texas and specifically, occurs in wetlands but can be found in grasslands and non-wetlands as well. Since it is more native to warmer, dryer climates, it is most likely better suited for those warmer climates. The natural flowering times for *Oe. rosea* is May - November, making these most likely day neutral plants (Lady Bird Johnson Wildflower Center).

The Oenothera genus has a tendency for invasive growth habits. Since most of the plants in this genus are biennial, high seed production is common for reproduction. This high seed production is often a trait of invasive species and can bring up possible problems. The most invasive of the genus are the biennials, they often "solve the problem of mortality risk in the critical period of germination and establishment by delaying flowering and seed production" (Mihulka, S et al. 2003). This description does not include the perennial *Oe. rosea*, and lessens its invasiveness. There is a possibility of invasive habits due to the fact that it is able to sense an adequate light environment, this means that it will not germinate until its requirements are met, and therefore increases its seedbank (Mihulka, S et al. 2003). The whole of the *Oenothera* genus was studied for its invasibility. A table from this studies article (Figure 5) is shown below looking at the varying species, if its biennial (B), annual (A) or perennial (P), the origin, the total number of nonnative locations it has popped up in 6 different European countries, and its invasiveness rate (Mihulka, S et al. 2003). Overall, *Oe. rosea* should not be an issue as an invasive

Figure 5: Table from article by Mihulka et al. on the invasiveness of the *Oenothera* species

Taxon	Author	Life form	Origin	Tot. n. of localities	Inv. rate
O. ammophila	Focke	B	cf. N. America	27	0.020
O. biennis	L.	B	N. America	794	0.031
O. caespitosa	Nutt.	P	N. America	0	0
O. coronifera	Renner	B	new European genotype?	0	0
O. erythrosepala	Borbás	B	N. America	339	0.035
O. fallax	Renner emend. Rostański	B	hybrid genotype *biennis* × *erythrosepala*	47	0.018
O. issleri	Rostański	B	hybrid genotype *biennis* × *syrticola*	15	0.010
O. lipsiensis	Rostański et Gutte	B	new European genotype?	0	0
O. missouriensis	Sims	P	N. America	3	0.008

candidate. Compared to some of the other localities, *Oenothera rosea* is quite low. This species also was found to have an invasive rate of 0.017, which is lower than some of the top spreaders. Oenothera rosea has also been introduced to many other areas and have since naturalized there without much issue (Mihulka, S et al. 2003). Oenothera rosea is not a risk to the United States as it is already native to these areas. Anywhere it would not previously seen in the United States, which would be northern areas, would have a cold season that the plant is not able to tolerate.

Traditionally, the rose evening primrose was used in Mexico as medicine for coughs, diarrhea and skin infections (Gomez-Flores, R et al. 2012). Now, *Oenothera rosea* has been studied for other properties it has. It has been discovered to have some antibacterial properties in the leaf. Some studies showed that, "Oe. rosea leaf extracts inhibit E. coli, S. enteritidis and Vibrio cholera growth" (Gomez-Flores, R et al. 2012). *Oenothera biennis* is a related species well known for its antibacterial properties, often used in creams and *Oe. paradoxa* may have antidiabetic properties (Munir, R et al, 2017). There's also been some testing for phenolic compounds in the plant. "*Oe. rosea* produces different phenolic compounds capable of reducing

the inflammation...They also reduced proinflammatory cytokines and increased anti-inflammatory cytokines… *Oe. rosea* could be considered of interest in inflammatory and painful diseases" (Vargas-Ruiz, R, 2020).

II. CROP SPECIES

A. History and Potential Uses.

Currently, *Oenothera rosea* is not popular in the horticulture market. There are some seeds and plants of *Oenothera speciosa* found in the market, but these are very few. These species are not usually sold for ornamental purposes, but used for research or medicinal properties. The species *Oe. rosea* is mostly referred to as a wildflower in the ornamental sense and it hasn't been cultivated yet. Though there is extensive research on the genus itself since multiple plant species, specifically *Oe. bienni*, are used in labs and for medical research.. Plants in this genus are usually planted by seed as they germinate quickly and easily (Greiner, S., & Köhl, K., 2014). There is a general acceptance for what the Oenothera genus needs in order for production, but exact requirements for *Oenothera rosea* have not been specified.

III. PRODUCTION INFORMATION

A. Anticipated Cultural Requirements.

The Oenothera species is defined as either biennials, or a short-lived perennial. Oenothera rosea is seen as a short-lived perennial because it is able to live a bit longer than two

years. Though this perennial is short lived, since it's in a family of biennials, it will usually reseed. This plant has the possibility to be a wonderful herbaceous perennial that can be used to fill in areas. This plant is also low to the ground, and only gets to around 2 feet tall (Lady Bird Wildflower Center). Not only will this plant bring a delicate flower to the perennial market, but it could also be used as an annual in colder climates. These small delicate flowers would be great as a bedding annual in northern areas with cold winters.

This plant is native to warmer, southern areas. As shown in Figure 6, it's found in states like California, Arizona, New Mexico and Texas (USDA Database). This would be in hardiness zones 8-10. This brings the possibility to use these species as both an annual plant or as a perennial. Any hardiness zone that is lower than 8 would need to utilize this plant as an annual bedding plant. Further breeding could be organized to create a species that has these cold hardiness abilities. *Oenothera rosea* is able to handle a decent amount of heat as well since it is in these warmer climates. The USDA heat zone is unknown for this specific species, as the exact locations of it in the southern states isn't well known. We can infer that it is somewhere within the 5-11 range for the USDA heat map since each of the states it is found in have this range. Any area that meets the heat and hardiness zone standards for this plant can then be utilized as a perennial.

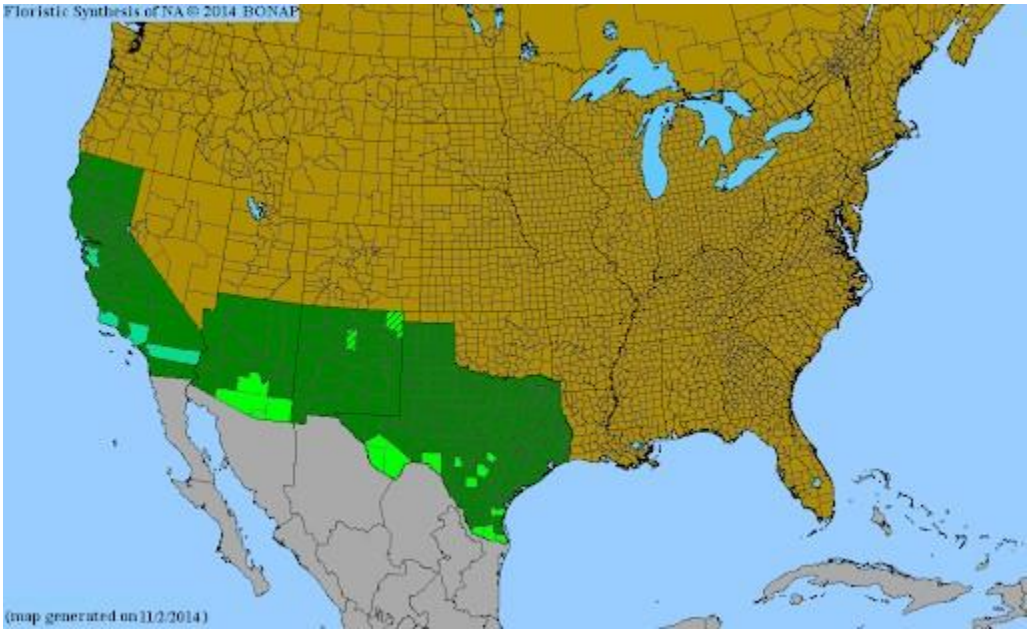


Figure 6: *Oenothera rosea* Distribution

Oenothera rosea specifically, hasn't been cultivated before. Fortunately, since a few types of the *Oenothera* plants are used for medicinal properties or for research, they have. The *Oenothera* genus requires both “light and moisture [for germination]” (Greiner, S., & Köhl, K., 2014). The seeds are very small and are spread across a tray and left uncovered to germinate. According to Greiner, seeds will usually germinate in about 1-2 weeks in normal conditions, but soaking the seeds for 24 hours in a cold dark area can increase the rate as well as the synchronicity of the germination. The genus germinates the best in the spring and in exposure to sun (Greiner, S., & Köhl, K., 2014). These would be There are varying flowering types within the species would be germinated in 288 plug trays. After germination they would be transferred to larger trays to promote establishment, these would most likely be 408 trays. These would be sold in the 408 trays when sold as annuals in colder climates for $3.99. When sold as a perennial, they would be moved to a gallon pot and sold for $8.99.

Oenothera rosea's distribution chain would start at development of the product. If the plant is not naturally suited for cultivation, some breeding will need to take place. This breeding would probably aim for more consistent flowering, bigger, more abundant flowers, height, and cold hardiness. This would most likely end up taking some time to develop the product that is ready to sell. After reaching this point, breeding and new cultivars can continue to be researched. Seed and vegetative products will be developed from this by either public or private breeding programs and companies. From this, producers, propagators and marketing companies will start to work together with their new product. These producers will work with the distributors to bring the product to commercial growers or seed companies to start the retail process. The retail market will cater to the general consumers, while the distributors will reach the landscape contractors for integration of the new species product in their businesses. All of these processes will help the *Oenothera rosea* species become more well known and bring demand for it.

B. Market Niche

Oenothera rosea would have a target sell date of around spring and summer. Spring would be targeted for annual sales, though it could be continued into the summer if there is success with the product. Both spring and summer would be targeted for sale as a perennial. The flowering time of *Oe. rosea* can be anytime from May-November in the warmer climates (USDA Plant Database). It's assumed that in closer climates, the flowering time would be shorter. Whether the flowers could be forced is unknown at this time. It would be best to be grown as a perennial or an annual in spring.

There could be some possible issues with how the species behaves in colder climates. As it is a warmer climate crop, some concerns for how this plant would behave in the cold can be addressed. There have been sightings of the Oenothera genus in countries outside of the United States like Germany and other areas of Europe (Mihulka, S et al. 2003). Many of these countries do not have the warm desert climate like Arizona, so it is reasonable to assume that the species will be able to adapt or be bred to have cold tolerance.

There are a few possible crops that are popular in the perennial market that have a similar look. Coreopsis is a perennial with a similar style to *Oe. rosea*. Though coreopsis has a daisy flower compared to the primrose shaped flower, both flowers are of similar size and have thin foliage and airy foliage (Figure 7). Coreopsis is sold as both an annual and a perennial, similar to how *Oe. rosea* can be sold. The differences between the plants are that Coreopsis is a drought tolerant plant while *Oe. rosea* prefers a bit less of a drought environment. The *Oenothera rosea* brings a bit of a different look to flowers and foliage than the coreopsis and has potential in the market because of this.

Perennial geranium, also known as cranesbill, would also be a similar plant in the market. It has similar small buttercup shaped flowers of similar colors. The flowers stick out over top on stocks over the low and intricate foliage (Figure 8). *Oe. rosea* would provide an option of very similar flowers, in look and color, as the geranium but with different foliage leaf shapes that would reach the base of the flower.

One *Oenothera* genus is currently on the perennial market, this species is *Oenothera macrocarpa*, also known as the Missouri Evening Primrose. This has a verys similar look to the *Oenothera rosea* species except for the fact that it has much larger yellow flowers (Figure 9).

This species has similar requirements as *Oenothera rosea,* like full sun, and shows that this plant has a possibility to work well in the industry. This plant is also hardy to Zone 2, which could bring breeding opportunities to the *Oe. rosea* species. In Table 1, it shows these properties and requirements between each of the similar perennial plants.



Figure 7: Coreopsis example



Figure 8: Geranium/ Cranesbill example



Figure 9: *Oenothera macrocarpa*

Table 1: *Oe. rosea* properties compared to similar plants in the market			
Plant Species	**Plant Height x Width (inches)**	**Color of Flower**	**Requirements**
Oenothera rosea	H 12-18 x W 12-18	Pink	Full sun
Oenothera macrocarpa	H 12-16 x W 18-20	Yellow	Full sun
Coreopsis	H 12-24 x W 12-24	Yellow/ Red/ Orange	Full sun
Geranium	H 12 x W 12-24	Purple/ Pink	Full sun/ part sun

This plant could fill a spot in a difficult area of peoples yards. *Oe. rosea* would be able to thrive anywhere with full sun. These beautiful pink flowers can bring a lovely wildflower filled, and natural feel to anyone's yard.

IV. PRODUCT INFORMATION GUIDE (PIG) & CROP SCHEDULE

Oenothera rosea is a plant that would need to be propagated by seed. It is not a woody plant and the *Oenothera* genus heavily relies on seed production so this will make seed propagation the easiest and most feasible process for cultivation. These seeds will be sown in 288 plug trays for initial germination. They are typically sown in January and will need to be exposed to light for the best germination rates (Greiner, S., & Köhl, K., 2014). Greenhouses grow optimally for this situation because these are for ornamental purposes and prevent weeds, pest damage, and keep them in optimal conditions until selling in retail.

A general germination experiment was done to attempt and determine the rate of germination in the *Oe. rosea* seeds. 96 cells of a 288 plug tray were seeded and left to germinate in the mist house of University of Minnesota-Twin Cities Plant Growth Facility. This germination took approximately 2 weeks. The seeds then sat on the capillary mat to provide fertilizer to the plant for three weeks, bringing the total weeks observed to 5 weeks. At the end of 5 weeks, there was decent growth being seen from the seeds (Figure 10).



Figure 10: 288 plug tray of *Oenothera rosea* after 5 weeks

Overall, this was a successful test to get a gauge on the germination rate of the seeds. The seeds of *Oe. rosea* were extremely small and it wasn't possible to count the amount of seeds that were spread onto the tray. The seeds were sprinkled in each cell, and it is assumed that it was an approximate average of 5 seeds per plug cell. To increase ease of sowing the correct amount, soaking seeds in 0.1% Agarose can promote this (Greiner, S., & Köhl, K., 2014). There was about a 65% germination rate in a tray of 96 cells. These seeds did not receive any treatment before sowing. Soaking seeds for 24 hours in a dark cold area can increase rates and germination in the plant (Greiner, S., & Köhl, K., 2014). Conditions should be around 4 to 10 degrees Celsius to complete the treatment correctly.

After germination, transplanting will need to take place to pots to grow in the greenhouse. Once the true leaves emerge after about a month, transplanting will need to happen, this is typically in February (Greiner, S., & Köhl, K., 2014). They are transplanted into individual pots, depending on if they are targeted for annuals or perennials. For perennials, a gallon pot would be preferred, for annuals 3.5" pots or 408 trays are used. Once they are transplanted to pots, growth and flower induction are the next steps in this process. Since *Oenothera rosea* flowers naturally from May to possibly November in warmer climates, it could be assumed that these are either a day neutral flowering type or a long day flowering type. Bud Initiation in its natural habitat is in May, with the lengthening of days, so this will be grown in a long day environment in the greenhouses. The flowering stage also may require vernalization of the plants. This would take place before putting in the long day environment. For the vernalization treatment, the pots would be moved to a colder area with temperatures at about 4-8 degrees Celsius (Greiner, S., & Köhl, K., 2014). This would take place for about 7- 14 days with light conditions of a 10 hour light cycle and a 14 hour dark cycle(Greiner, S., & Köhl, K., 2014). This would help initiate flower buds. After this vernalization period, the pots would be moved back into their long day environment in the greenhouse. After about three to four weeks, the flower bud should be initiated. Once these buds are initiated it should take about 2 weeks for these buds to open and

be ready for shipment out for retail. After the product is ready for shipment, the pots will be distributed to wholesale and retail markets across the country for selling.

Table 2: *Oenothera* Cultivation Stages and Time Frame Summary

Stages	Time Frame (days)	Description
Soaking Seeds	1	Soaking seeds for 24 hours in cold and dark area at 4 - 10 degrees Celsius
Germination	7-10	In area with light and moisture for about 7 to 10 days in 288 plug trays
Transplant to Pots	10-16	Transplanting to a larger size pot after about 2 weeks of growth in plugs
Vernalization	7-14	Moved to temperatures of 4-8 degrees Celsius and 10 hours of light and 14 hours of dark conditions.
Flower Bud Initiation	21-28	Moved back into long day conditions for flower bud initiation
Flower Development	14-20	Opening of flowers in long day environment

The *Oenothera rosea* species, since it has not been cultivated before, would need a considerable amount of work with breeders and researchers to help get a better understanding about it. Research needs to be done more on the conditions that *Oenothera rosea* is able to tolerate. There is no current hardiness zone or heat zone available for this plant that is well researched or proven. Only estimates are able to be made on what this plant is able to handle by the locations it is currently located and found in. These locations being warmer, it is assumed it isn't able to tolerate cold temperatures, but is able to tolerate heat. Though it is found in these areas, the genus itself has a tendency to naturalize in other areas (Mihulka, S et al. 2003). There

needs to be a determined hardiness zone as well as heat zone before this plant can be sold in the markets. This is needed to know which markets will have the most demand for this product. More research and information is needed on the *Oe. rosea* species to know what areas it is to be sold as a perennial and which to be sold as an annual.

Customers and landscapes may be hesitant to use this species in yards as is. Plant breeders could be able to work with the species and help make it into a more attractive cultivar for these markets. Work on flower size could bring a lot of interest to the plant. Since the flower is quite small and not flashy, that may appeal to less customers. Most customers are looking for bright colors and big flowers in their garden. Though the species brings a lovely, airy and natural feel to the landscape, it isn't the traditionally desired look. Flower size has the possibility to be improved in this situation. Flower number is also a possible improvement in the plant. To keep the airy look of the plant but improving color and aesthetic, and increase in flower number could bring good results. Similar to a coreopsis or plants like baby's breath, these plants have the airy look with high quantities of flowers. This could greatly increase the marketability of the plant. Cold hardiness and tolerance have the ability to be improved alongside aesthetic improvements. There are species in the Oenothera genus that are able to withstand colder temperatures and cold winters.

V. ACKNOWLEDGEMENTS

Acknowledgements to the Lady Bird Wildflower Centers website provides ample information on habitat and locations and Greiner and Köhls article on growing information.

VI. LITERATURE CITED

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