

CARL WHITCOMB: Oxygen content in the medium is a function of both surface area and depth. However, pulling in the oxygen at the surface is a function of depth since gravitational pull increases as the height of the soil column becomes greater.

I do not feel field soil has a place in container production. Maintaining good water relations is very difficult, and sooner or later *Phytophthora* becomes a serious problem.

JOSE GARCIA: Are these pots available?

CARL WHITCOMB: We have contacted two manufacturers, but they are not producing them so far.

## GROUND COVERS FOR HIGHWAY USE

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**Abstract.** Over 200 different kinds of plants were investigated over eight years for their adaptability, hardiness, propagation, maintenance, and general suitability for use as ground covers on slopes, medians, and flat areas along highways in Louisiana. Rating for overall appearance, weed presence and crop establishment over a 13 month period indicated that liriope rated highest significantly. *Lonicera japonica* 'Purpurea', *Trachelospermum asiaticum* and *Wedelia trilobata* rated highly also. *Wedelia* kills back to the ground after exposure to 28°F. The others are evergreen.

Research was initiated in July, 1973, with the Louisiana State Highway Department to learn which low-growing ground cover, preferably under 2 ft, could be used to enhance safety and beauty, prevent erosion and reduce maintenance costs primarily on slopes, on entries and exits along the interstate highways (4).

There was very little information available on low-growing herbaceous and woody materials for the South (1,2,3). This study was undertaken with the following objectives: to obtain, select, and propagate plants for trial; to learn the best method of propagating and producing them; and to set up replicated field trials to learn how they would establish under local conditions. Ultimately the goal was to make recommendations for future plantings based on information obtained.

## MATERIALS AND METHODS

A review of the literature was started in 1973 and collection made of various plant materials that had possibilities of fulfilling the objectives. Over the 8 year period 8 different

plantings were made

Plants were usually started by cuttings or divisions, depending on species. They were placed in 2¼ to 3 in pots using, basically, 85% shredded pine bark, 5% washed builders sand, and 10% gravelite (a baked montmorillonite clay) Osmocote (18-6-12) at 5 lbs, dolomitic limestone at 10 lbs, hydrated lime at 2 lbs, and fritted trace elements at ¼ lbs per cu yd were applied. If phosphate was low, it was added at 2 lb/yd<sup>3</sup>. A 20-20-20 soluble fertilizer at 100 ppm was applied every 2 weeks while the liners were in the lathhouse. After plants were large enough to put in trade gallons, they were moved to full sunlight and fertilized every 4 weeks with Osmocote at 42 grams (about 1.4 oz) per container.

For the last planting 8 different plants were selected to be replicated at 3 different locations. By that time a great deal had been learned. Plants in general that would tolerate full sunlight were needed. Cultivation and use of a mulch on these steep slopes gave excessive erosion. Erosion was minimal if original cover was killed and holes made staggered from row to row on the slope. Holes were made by a power digger. Plantings should be completed ideally in February. From results of the preliminary tests the following 8 plant materials were selected for replicated trials at 3 different sites in the Baton Rouge area:

*Trachelospermum asiaticum*, dwarf Confederate jasmine; *Lonicera japonica* 'Purpurea', purple honeysuckle; *Euonymus fortunei* 'Colorata', bronze wintercreeper; *Coreopsis auriculata* 'Nana', dwarf coreopsis; *Asparagus densiflorus* 'Sprengers Compacta', dwarf compact asparagus fern, *Verbena peruviana* 'St. Paul', St. Paul verbena, and *Wedelia trilobata*, wedelia.

Over the years these plants had shown fast establishment, good coverage and relative freedom from diseases and insects.

A randomized planting was made at each location with individual plantings running from top to bottom of the slope or across the plot. Individual plantings varied depending on species and were 12 inches from center to center of the balls for the fern, coreopsis, and liriope, 15 inches for verbena, 20 inches for the dwarf Confederate jasmine and 24 inches for the wintercreeper, honeysuckle and wedelia. Plantings were completed on April 20, 1980.

Monthly ratings were made by 6 judges starting in June for overall crop appearance, weeds present and establishment of each crop plant in each of the 3 replications. An extended period of drought from May 20 to June 19, 1980 and August, 1980 took out most of the dwarf coreopsis and verbenas, thus

eliminating these two plants from the statistical analyses.

Herbicides applied in the fall before cool temperatures set in did not kill all existing vegetation; therefore, weed control was started as soon as the plantings were completed. Paraquat was applied between the rows. While plants were small, they were covered with plastic containers, and spraying was done within the rows, too. Johnson grass and Bermuda grass were the 2 worst weeds encountered. Glyphosate (Roundup) was applied over the dwarf Confederate jasmine after it was well established at the rate of 10 ml/l, and at 5 ml/l over the honeysuckle and wintercreeper. There was no visual damage. The jasmine had terminal buds killed and more breaks induced from the herbicide. Four sprayings were made of glyphosate during the growing season. Hand weeding was done on the other species, which were susceptible to injury.

In 1981 glyphosate was used twice over crops having tolerance. Quickdraw, a bar applicator containing a solution of glyphosate, was used primarily to control the tall weeds like Johnson grass. This bar had a solution of 2 parts glyphosate to 1 part water on a volume basis. The bar was used 3 times during the growing season.

## RESULTS

Overall establishment ratings were made for the three replications by 6 judges. A rating of 1 to 9 was used, with 9 indicating the highest number of plants per plot. Analyses of variance were made for each month from June, 1980 through June, 1981 and for the entire 13 month period for the 6 species.

For the first date in June, lirioppe received the best rating followed by wedelia and honeysuckle. Lirioppe plants were spaced closer, resulting in fewer weeds and less weed competition. The overall rating in June 1981 was, in order: lirioppe, jasmine, and honeysuckle, indicating that lirioppe tended to establish the most rapidly.

For weed ratings the same general pattern was shown among species. Significantly more weeds were found in the wintercreeper plots. The honeysuckle and wedelia plots had significantly more weeds than jasmine and lirioppe plots. No herbicides were applied to the wedelia, which is very susceptible to glyphosate. The honeysuckle had a more open nature, thus greater weed penetration. In general the lirioppe had the fewest weeds; however, weed populations were not significantly less than in the jasmine, which had had periodic herbicide applications. Whether these sprays will have a long term effect on the jasmine will have to be determined.

In conclusion the lirioppe performed best over this 13 month period followed closely by the honeysuckle, jasmine, and wedelia, which could be placed in a second group. The wintercreeper and fern appeared to require a longer time to establish. Ratings are being continued for another year to observe which species will develop a solid cover and be resistant to weed penetration. Thus far the wedelia and honeysuckle appear to become more dense with less weeds than in the lirioppe.

## DISCUSSION

All vegetation should be killed before a planting is started. Fumigants that can be watered-in should be tried. If glyphosate and 2,4-D are used, at least 3 sprayings spaced a minimum of 2 weeks apart should be made to kill all grasses and weeds. Weeds should be in active growth and temperatures 70°F or above, when herbicides are applied. If the area is rototilled, some method to prevent erosion is necessary. Shredded bark did not prove successful between plants for heavy rains carried it down the slopes. Possibly straw or erosion netting might be used. Digging holes staggered from row to row and not cultivating the soil resulted in less erosion.

*Akebia quinata*, five-leaf akebia; *Arundinaria pygmaea*, dwarf bamboo; *Lantana montevidensis*, trailing lantana; *Miscanthus sinensis* 'Variegatus', variegated eulalia, *Rubus parviflorus*, thimbleberry; and *Shibatea kumasaca*, kumasaca are others which showed much promise in small trials.

Table 1 gives the ground-cover plants, their characteristics and evaluation.

Table 1 Ground covers showing promise in Louisiana trials

Scientific/ common names	Height (cm)	Spacing (cm)	Propa- gation*	Remarks
<i>Achillea Millefolium</i> L Common yarrow	55	30 5	d	Slow to increase. Cut seed heads in July. Drought tolerant, attractive flowers.
<i>Ajuga reptans</i> L Carpet bugleweed	8	30 5	r	Full sun not tolerated. Root rots and nematodes problem.
<i>Akebia quinata</i> (Houtt) Decne Five leaf akebia	15	50 8	c	2 to 3 per container. Quick spread. Competes well with weeds. Dense cover. One of the best.
<i>Arundinaria pygmaea</i> (Miq) Asch & Graebn Dwarf Bamboo	30	30 5	d	Propagation & establishment slow. Drought tolerant. Pest free. Dense cover in time, poor growth in containers.

\* Propagation by c - cuttings, d - division, l - layering, r - runners; s - seeds, x - rhizomes

Scientific/ common names	Height (cm)	Spacing (cm)	Propa- gation*	Remarks
<i>Asparagus densiflorus</i> (Kunth) Jessop 'Sprengeri Compacta' Dwarf compact as- paragus fern	48	30 5	d	Propagation & establishment slow Weed competition poor Better fertility & mois- ture needed
<i>Aspidistra elatior</i> Blume Cast-iron plant	60	30 5	d	Slow Little lateral spread Deep shade tolerant, not full sun
<i>Chrysanthemum X su- perbum</i> Bergmans ex J In- gram Shasta daisy	15	30 5	d	Slow Rosette growth flow- ers up to 55cm High main- tenance Attractive flowers & foliage
<i>Coreopsis auriculata</i> L 'Nana' Dwarf coreopsis	10	30 5	d	Fast Succumbed to extend- ing drought in test Shallow but dense root Considered one of best Species more vigorous but taller growth
<i>Duchesnea indica</i> (Andr.) Focke Mock Strawberry	8	30 5	r	Fast Hard to get dense cov- er in full sun Shallow roots Spreading
<i>Euonymus Fortunei</i> (Tarcz.) Hand-Mazz 'Colorata' Bronze winter-creep- er	15	61	c.1	Fast Dense cover in sea- sons Purple leaves in win- ter One of best
<i>Glechoma hederacea</i> L Ground ivy or Creeping Charlie	6	38 1	c.1	Fast in moist soil & cool temperatures Intolerant of hot, dry conditions
<i>Hedera canariensis</i> Willd Algerian ivy	12	61	c	Fast but slow to establish Prefers some shade Fair tolerance to drought
<i>Hemerocallis fulva</i> (L.) L. Tawny daylily	38	30 5	d	Slow Lateral spread very slow Drought tolerant Per- sistent Attractive flowers Evergreen Flower stalks taller
<i>Juniperus conferta</i> Parh Shore juniper	15	50 8	c	Slow Mites a problem Loss by pilferage great
<i>Lantana monteviden- sis</i> (K Spreng.) Briq Trailing lantana	60	61	c	Fast Species evergreen but hybrids killed by frosts to ground line Beautiful, long- season flowering More trails One of best
<i>Liriope muscari</i> (Decne.) L H Bailey Big-blue liriope				Quite rapid Attractive flowers Evergreen Drought tolerant Pest free Some lat- eral spreading One of best

Scientific/ common names	Height (cm)	Spacing (cm)	Propa- gation'	Remarks
<i>Liriope spicata</i> Lour Creeping liriope				Similar but more lateral spreading Faster establishment Narrower leaf & flowers not as nice One of best
<i>Lonicera japonica</i> Thunb 'Purpurea' Purple-leaved honeysuckle				Fast Dense cover usually in 2 growing seasons. Leaves very purple in winter Attractive flowers Hasn't reseeded like species One of very best
<i>Lysimachia Nummularia</i> L Moneywort or turkey ivy				Fast Roots along stems Prefers some shade Dense cover Shallow roots and not drought tolerant
<i>Miscanthus sinensis</i> 'Variegatus' Variegated eulalia or cemetery grass	75	50 8	d	Fast Flower heads to 1 meter Lateral spread good Drought tolerant One of very best
<i>Ophiopogon japonicus</i> (Thunb ) Ker-Gawl Mondo grass or lily turf	25	30 5	d	Rapid Few pests Drought tolerant Grows & spreads under taller weeds & grasses One of best
<i>Rosa Wichuriana</i> Crep Memorial rose	60	161	c	Quite rapid Prune to spread & get denser Leaf disease, drought and low temperature cause leaf drop Flowers in May Good
<i>Rosmarinus officinalis</i> L 'Lockwoodii' Lockwood rosemary	38	30 5	c	Slow Drought tolerant but not to wet conditions Attractive foliage & flowers Rather open
<i>Rubus parviflorus</i> Nutt Thimbleberry or creeping raspberry	60	61	c	Rapid Prune to get dense Competes well Persistent No leaf diseases One of best No flowering yet
<i>Rudbeckia hirta</i> L Black-eyed susan	60	38 1	s.d	Rapid Not all perennials some died out Reseeds Drought tolerant Attractive flowers Rosette with flower stalk to 60cm and more
<i>Santolina</i> <i>Chamaecyparissus</i> Lavender cotton	50	30 5	c.d	Slow Clumpy rosette growth Disease problem in wet weather Species <i>S virgens</i> was similar
<i>Shibatea kumasaca</i> (Zoll ex Steud) Mak- ai Kumasaca	50	30 5	d.x	Fairly rapid Drought tolerant No pests Lateral spreading Poor growth in containers Needs more testing

Scientific/ common names	Height (cm)	Spacing (cm)	Propa- gation*	Remarks
<i>Teucrium chamaedrys</i> 'Prostratum' L Dwarf germander	25	30 5	c	Fairly rapid. Drought tolerant but not of wet conditions Attractive dark green foliage and flowers
<i>Trachelospermum asiaticum</i> (Siebold & Succ ) Nakai Dwarf confederate (Jasmine)	46	50 8	c,1 c	Rapid 2 to 3 cutting per container Slow to establish but dense cover in second season usually Pest free Evergreen One of very best.
<i>Verbena peruviana</i> (L) Britt 'St Paul' St Paul verbena	15	38 1	c	Fast and quick spread White fly and mite susceptible Intolerant of extended drought until well-established Rather shallow roots but dense & root along decumbent branches Very attractive & long flowering Good
<i>Vinca major</i> L Big or Greater periwinkle	48	38 1	c,1	Fairly rapid Prefers some shade Hard to get dense stand Spreads fast Competes well with other plants
<i>Wedelia trilobata</i> (L ) A S Hitchc Wedelia	38	61	c	Very rapid Spreads fast Dense cover Attractive foliage & yellow flowers Kills to ground annually at about 28°F. Slow next spring to emerge Competes well One of best

### LITERATURE CITED

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