COOPERATIVE EXTENSION
WASHINGTON STATE UNIVERSITY
KING COUNTY

http://www.metrokc.gov/wsu-ce

919 SW Grady Way, Suite 120
Renton, WA 98055-2980
(206) 205-3100, 711(TTY)

Comparing Yields with Land Equivalent Ratio (LER)

Agriculture and Natural Resources Fact Sheet #532

Though research shows there are many advantages of growing two or more crops together (see Fact Sheet #531: *Intercropping*), intercropping can also result in disadvantages. Practical challenges such as weeding and harvesting as well as decreased yields are reasons to carefully evaluate intercropping arrangements.

Land Equivalent Ratio (LER)

One way to assess the benefits of growing two or more crops together, or intercropping, is to measure productivity using the Land Equivalent Ratio (LER). LER compares the yields from growing two or more crops together with yields from growing the same crops in monocultures or pure stands. The idea behind intercropping is to capitalize on the beneficial interactions between crops while avoiding negative interactions. Essentially, the LER measures the effect of both beneficial and negative interactions between crops.

To calculate the LER, divide the intercrop yield of one crop (e.g., corn) by the yield of the pure stand and add that to the intercrop yield of the next crop (e.g. beans) divided by the yield of the pure stand and so on. The equation goes like this:

intercrop1/pure crop1 +
intercrop2/ pure crop2 + etc. = LER.

or

intercrop corn/pure corn +
intercrop beans/pure beans + etc. = LER

The resulting number is a ratio that indicates the amount of land needed to grow both crops together compared to the amount of land needed to grow pure stands of each. An LER greater than 1.0 usually shows that intercropping is advantageous and less than 1.0 shows a disadvantage. For example, an LER of 1.15 means that an area planted as a pure stand, or monoculture, would require 15% more land to produce the same yield as the same area planted in an intercrop combination. An LER of 2.0 means the intercropped area would produce twice as much as the monoculture. On the other hand, an LER of 0.80 indicates the intercrop yield was only 80% of the yield of the pure stand.

Collecting Data

For crops that are harvested just one time, yield data should be collected when the crop is ready for market. For crops harvested multiple times, such as pole beans or tomatoes, data should be collected when a sizable portion has reached market size and at regular intervals over the harvest period. For the best results, designate uniform plots and harvest from within the centers of each one in order to avoid measuring edge effects. For crops harvested more than once, be sure to harvest the same area at each harvest. Avoid collecting harvest data from outside rows and ends. An LER can also be measured in garden beds while avoiding edge effects. Beds should be at least 4 rows wide and 10 plants long so that the area you are measuring in the center is 2 rows wide and 6 plants long.

Be sure to collect the harvest in containers that can be clearly labeled with the plot number, location, harvest date and crop type. Harvest and measure the portion of the plant that is marketable. Harvest the same way for pure stands and for intercrops but be sure to keep the component crops of the intercrop in separate containers. Measure and record the total weight of each crop harvested. (See Table 1 on next page).

Other Clues and Economic Considerations

Additional information such as soil temperature and moisture, pest damage, and weediness may shed light on factors that affect yields. The plots you set up for measuring LERs can also be used for collecting such data with little additional effort. For more information on conducting research and collecting data on your farm, start with the publications listed in the Resources section of this document.

You can also use an LER based on market prices to determine whether a crop is as profitable or more profitable than the same crop grown as a monoculture. Higher yields do not always mean higher profits. A high yielding crop is not necessarily a high-profit crop. To calculate an

Table 1. Sample Data Collection Sheet

Harvest	Week 1	Week 2	Week 3	Week 4	Total
Crop A Pure Stand	—	—	—	93 lbs	93 lbs
Crop B Pure Stand	5 lbs	15 lbs	18 lbs	12 lbs	60 lbs
Crop C Pure Stand	10 lbs	20 lbs	20 lbs	15 lbs	65 lbs
Crop A Intercrop	—	—	—	102 lbs	102 lbs
Crop B Intercrop	2 lbs	3 lbs	6 lbs	4 lbs	15 lbs
Crop C Intercrop	—	3 lbs	4 lbs	3 lbs	10 lbs

economic LER simply use prevailing per pound market prices in the LER formula. Remember, however, that the LER alone cannot indicate profitability because other costs involved with producing intercrops versus monocultures must be taken into account.

Examples

The sample data collection sheet and sample LER data sheet on this page show how yield data might be collected and used to compare yields from an intercrop arrangement with pure stands of each crop.

Table 2. Sample Land Equivalent Ratio (LER) Data

	Intercrop Yield (lbs/acre)	Pure Stand Yield (lbs/acre)	Partial LER
Crop A	102	93	102/93 = 1.10
Crop B	15	60	15/60 = 0.25
Crop C	10	65	10/65 = 0.15
Total LER	—	—	**1.50**

In the LER data example, the partial LER of 1.10 for Crop A indicates that 10% more land would be required to yield the same amount as that yielded from the intercrop arrangement with Crops B and C. The total LER of 1.5 shows that 50% more land would be needed to produce the combined yields of all three crops if they were to be grown as pure stands. In this case, if Crop A is the high value crop, then there is a clear advantage in yield from growing it with Crops B and C.

Resources

Anderson, D. *On-Farm Research Guidebook*. Department of Agricultural Economics, University of Illinois. Contact Dan Anderson at (217) 333-1588; email: aslan@uiuc.edu.

Miller, B. et. al. 1993. *On-Farm Testing: A Growers Guide*. EB 1706. Washington State University Cooperative Extension. Available for $1.50 plus tax by calling (206) 296-3900.

Sustainable Agriculture Network (SAN). *How to Conduct Research on Your Farm or Ranch*. Available from SAN (301) 504-6425; email: san@nal.usda.gov or on the web at http://www.sare.org/san/htdocs/pubs/.

Sources

Gliessman, S. 1998. *Agroecology: Ecological Processes in Sustainable Agriculture*. Sleeping Bear Press, Chelsea, MI.

Sullivan, P. 1998. *Intercropping Principles and Production Practices*. Appropriate Technology Transfer for Rural Areas (ATTRA), Fayetteville, AR.

Alternate formats available upon request. 206-205-3100 (TTY 711)

Written by Sylvia Kantor, WSU Cooperative Extension King County, 1999. Reviewed by Steve Gliessman, UC Santa Cruz; David Granatstien, WSU Cooperative Extension, WWREC; Carol Miles, WSU Cooperative Extension, Lewis County.

Cooperating agencies: Washington State University, U.S. Department of Agriculture, and King County. Cooperative Extension programs and employment are available to all without discrimination. Evidence of noncompliance may be reported through your local Cooperative Extension office.