Machine Vision

The wages paid for grading, counting, and handling seedlings during the harvesting operation can account for about one-third of the total production cost in a bareroot nursery. It has been documented that a worker on the packing line can grade a seedling every 1 to 3 seconds with an error rate of 7 to 8 %. Machine vision is a new technology that is being widely used to count and grade other types of agricultural products. Since the late 1980's, the Missoula Technology and Development Center has been working with researchers at Oklahoma State University to develop a Machine Vision System for counting and measuring bareroot seedlings on the grading belt **(Figure L).** This system has been operationally tested at the J. Herbert Stone Nursery in Medford, Oregon, and the results show that variation in seedling dimension measurements was better than manual grading for most attributes, and also allowed the calculations of other useful morphological indices **(Table 5).** The process should work even better for container seedlings. The next step is to expand the capability of Machine Vision to include color into the grading evaluation, so that insect and disease damage, and other types of injury can be detected. In the near future, nursery workers may only have to separate the bareroot seedlings, or extract the container seedlings and place them on the grading belt where machine vision can do the rest. The potential for this new technology is exciting and the latest developments will be reported at the regional nursery meetings.

Source:

Rigney, M.P.; Kranzler, G.A. 1994. Machine vision inspection system for packing house quality control. IN: Landis, T.D.; Dumorese, R,K. tech. coords. National Proceedings, Forest and Conservation Nursery Associations. Gen. Tech. Rep. RM-257. Ft. Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station: 182-191.

Lowman, B.J. 1995. Seedling Grading Machine Project, No. XE52E62. Missoula, MT: USDA Forest Service, FY1995 Technology & Development Project Status Mid-Year Report.

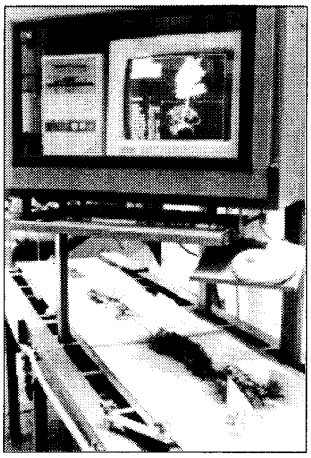

Figure L: Machine vision equipment can count and measure seedlings as they pass on the grading belt (courtesy of Rigney and Kranzler)

Table 5 - Comparison of the precision of machine vision to manual grading (modified from Rigney and Kranzler)

Morphological Attribute	Units	Machine Vision CV (%)	Manual Grading CV (%)
Stem Diameter	mm	1.4	6.6
Shoot Height cm	2.7	3.0	
Root Length	cm	6.6	4.8
Sturdiness	ratio	3.9	7.3
Shoot: Root	ratio	3.5	Not Done
Fine Roots	%	6.0	Not Done
Root Area	cm^2	2.5	Not Done
Shoot Area	cm^2	1.8	Not Done

CV = Coefficient of variation which is the standard error of the mean divided by the treatment mean.