Agricultural Economics and Policy: Practical #3B

February 11, 2016

Given the following information for a 1500 ac farm, construct a linear programming model that determines how much of each crop to plant.

Crop	Observed Acreage (ac)	Average Yield (bu/ac)	Price ($/bu)	Average costs ($/ac)
Wheat	500	42	$7.50	$192.0
Barley	200	70	$4.25	$169.5
Canola	450	38	$11.50	$229.0
Peas	250	45	$6.75	$163.8
Oats	100	110	$2.75	$152.50

1. Solve the following simple model using GAMS:

Maximize $$\text{R} = \sum_{k=1}^{n} (p_k x_k y_k - c_k x_k)$$

Subject to $$\sum_{k=1}^{n} x_k \leq 1500$$

$$x_k \geq 0$$

2. Now include the following constraint and solve the problem again:

$$x_k \leq x_k^{obs} + 0.01, \forall k$$

For these constraints find the associated shadow prices, λ_k, and use this information to modify the objective function above assuming a quadratic cost function: $c_k = a\, x_k + ½\, b\, x_k^2$. Then:

$b_k = 2 \times \lambda_k / x_k^{obs}$ and $a_k = c_k - ½ \times b_k \times x_k^{obs}$

Use the cost function in place of $c_k\, x_k$ in the objective function, so the revised objective is:

Maximize $$\text{R} = \sum_{k=1}^{n} (p_k x_k y_k - a_k x_k - \frac{1}{2} b_k x_k^2)$$

Solve the revised problem using GAMS.