What Makes Soil Sampling More Durable than Yield Monitors

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NC STATE UNIVERSITY

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OBJECTIVE

Employ a duration analysis that accounts for selectivity bias to investigate the impact of different variables on the speed of abandonment of precision technologies (PF) for cotton farmers in the Southeastern US.

INTRODUCTION

SAMPLING: has been the most widely adopted precision farming technology, for which farmers had sufficient time to evaluate.

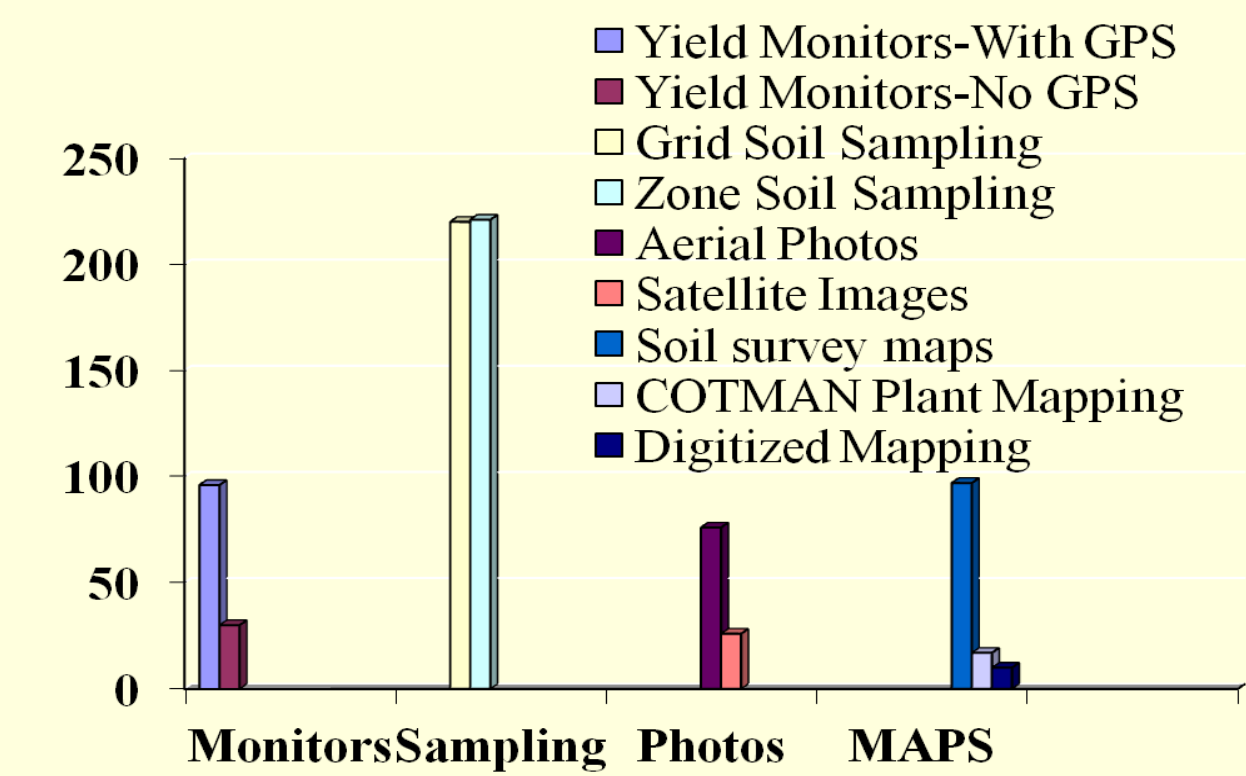**MONITORS** is the most recent PF technology that became commercially viable in 1997.

Figure 1 Farmers using different technologies

FRAMEWORK and EMPIRICAL METHODS

The farmer abandons the PF technology at time t if the expected utility from PF (U_{PFt}) becomes less than the expected utility from not using PF (U_{nt})

[1] $U_{PFt} < U_{nt}$ or $U_t^* = U_{PFt} - U_{nt} < 0$

The utility from adopting PF technology is assumed to be driven by monetary benefits M_{PFt} (i.e. direct monetary or profit benefits) and non-monetary benefits E_{PFt} (i.e., environmental or cotton quality benefits) such that

[2] $U_{PFt} = M_{PFt} + E_{PFt}$ with

$M_{PFt} = \alpha X_{PFt} + \varepsilon_{PFt}$ and $E_{PFt} = \bar{E}_{PFt} + e_{PFt}$

where X_{PFt} observable farmer/farm characteristics, and $\bar{E}_{PFt}$ observable or perceived non-monetary benefits.

The utility from non adopting (opportunity cost of SSIG) is given by

[3] $U_{nt} = \bar{U}_{nt} + \mu_{st}$

Thus the decision to abandon is shown as:

[4] $U^* = \alpha X_{PFt} + \bar{E}_{PFt} - \bar{U}_{PFt} + u_{PFt} < 0$

which empirically is estimated via:

[5] $f(t_i) = Z_i(t_i)b + X_i(t_i)c + \theta_t$

with X_i, time invariant regressors and $Z_i(t_i)$ time varying regressors.

DATA: a 2009 survey conveying information about farm and cotton farmers' characteristics in 12 Southeastern States.
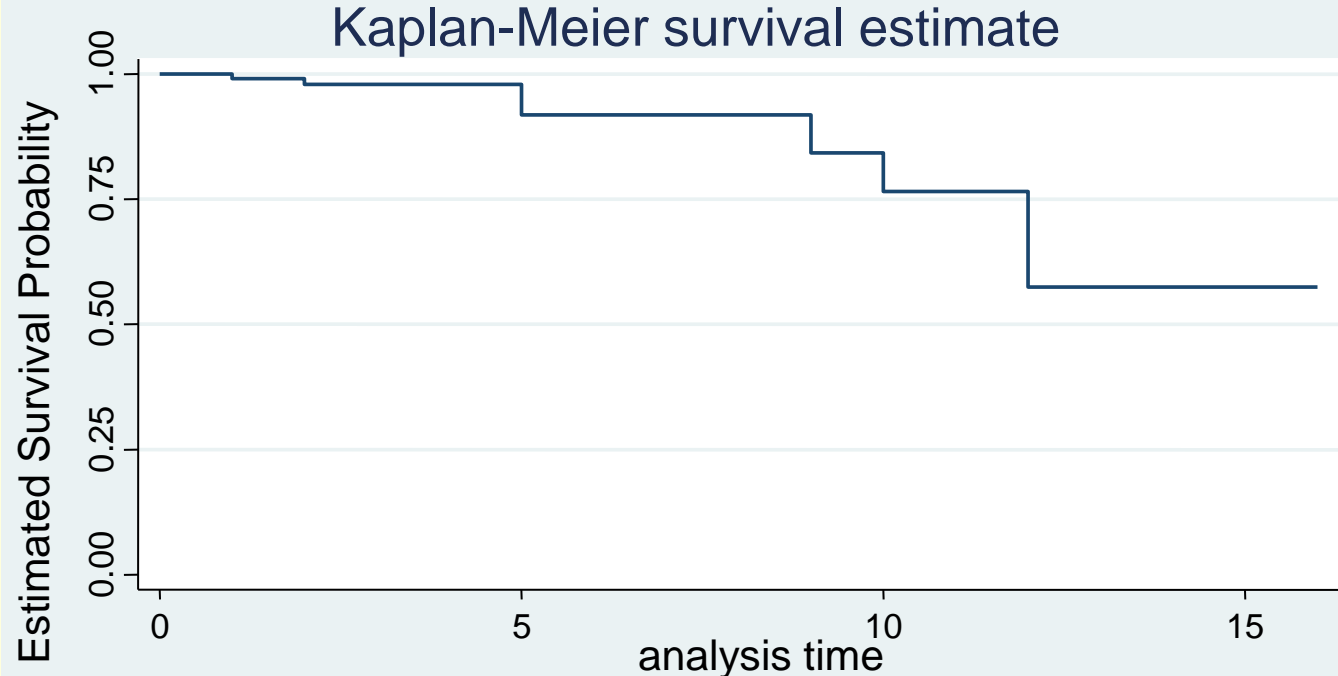

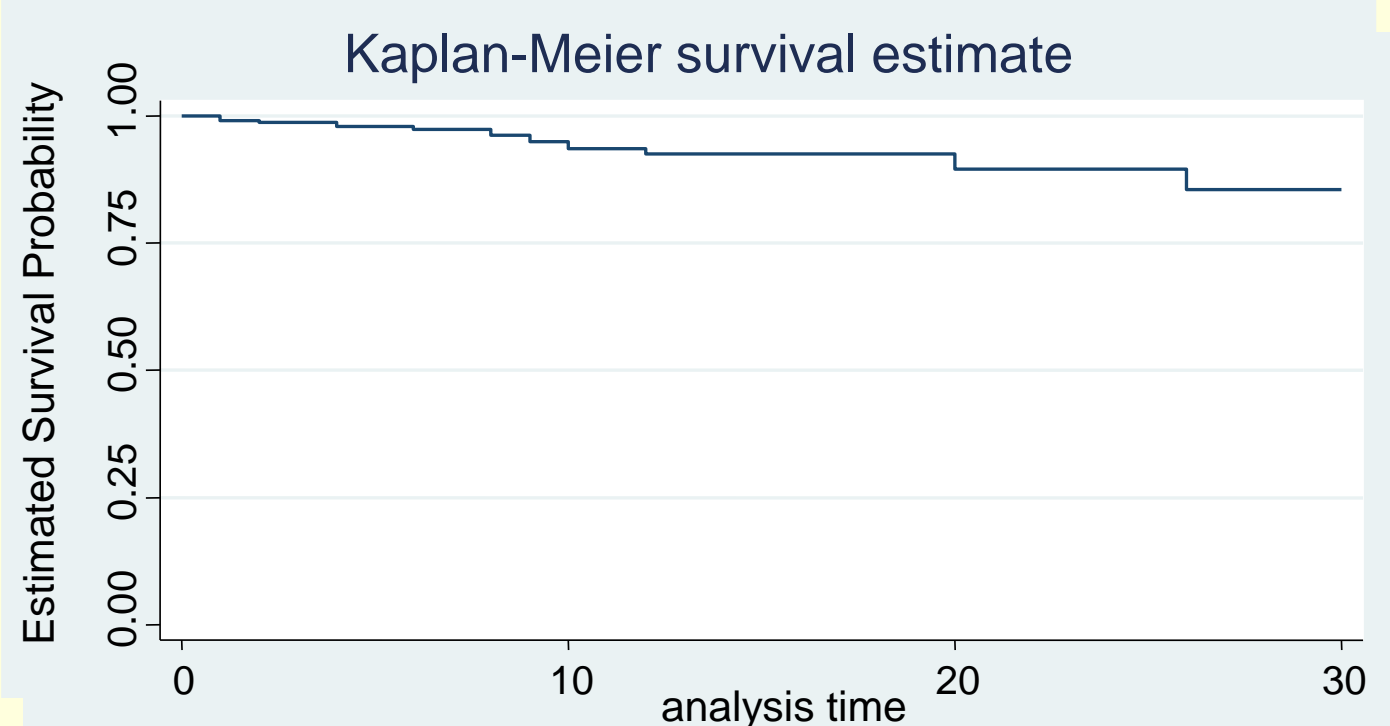**Figure 2** KM survival curve of MONITORS' duration

Figure 3 KM survival curve of SAMPLING' duration

Given the potential issues of right-censoring, duration dependence, and selection problems, a duration model that accounts for sample selection is the appropriate estimation procedure.

For MONITORS and SAMPLING, the AIC yields the smallest value for the Weibull distribution. Thus, the Weibull functional form is preferred.

We use July humidity and temperature to control for selection bias.

RESULTS

Variables	SAMPLING Weibull	MONITORS Weibull
EDUCATION	0.029 (0.059)	-0.219 * (0.127)
EXPERIENCE	-0.027 ** (0.010)	-0.061 ** (0.031)
PUBLICATIONS	-0.113 (0.278)	0.923 (0.812)
VARIABILITY	0.004 (0.007)	0.018 (0.019)
COMPUTER	0.084 (0.254)	-0.520 (0.604)
IMPORTANCE	-0.066 (0.525)	-2.894 ** (1.301)
PROFIT	0.476 (0.299)	0.316 (0.684)
INCOME	-0.006 (0.004)	-0.026 ** (0.010)
EASEMENT	0.009 (0.361)	-0.484 (1.493)
PLAN	-0.185 * (0.095)	-0.069 (0.267)
MANURE	-0.102 (0.263)	0.650 (0.674)
ACRES	0.0003 ** (0.0001)	0.0002 (0.0002)
YIELDS	0.0001 (0.0003)	0.0005 (0.0006)
QUALITY	-0.394 (0.304)	-0.516 (0.926)
ENVIRONMEN	0.157 (0.254)	-0.178 (0.675)

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[2] Walton, J., Lambert, D., Roberts, R., Larson, J., English, B., Larkin, S., Martin, S., Marra, M., Paxton, K., Reeves, J., 2007, "Adoption and Abandonment of Precision Soil Sampling in Cotton Production", *Journal of Agricultural and Resource Economics*, 33 (3): 428-44.