Short-term benefits of zero-tillage in tropical grain production

R.L. McCown[1], R.K. Jones[2] and D.C.I. Peake[3]

CSIRO Div. Tropical Crops and Pastures, Townsville[1], Brisbane[2], Katherine[3]

"Zero tillage" or "direct drilling" of crops into pasture residues appears to be a very promising practice in the tropics, although our understanding of its implications lags behind that in temperate environments. Surface mulch has been found to increase infiltration, decrease runoff and erosion, reduce soil temperatures, and increase post-emergent growth and yields of maize (Lal 1974, 1978). In northern Australia, erosion has been so serious in previous cropping ventures that zero-tillage appears essential on the grounds of soil conservation alone. This paper reports findings from Katherine, N.T. in 1978-1979 that elucidate short-term effects.

In one experiment on a sandy red earth, the soil was rotary hoed and 5000 kg/ha of grass-legume hay spread over the 63 cm inter-row zone of maize, grain sorghum, and bulrush millet planted at 75 cm row spacings. Control plots had no mulch applied. Table 1 shows that maximum soil temperatures on a typical day during emergence were extremely high on the no-mulch plots. Mulch on the inter-row zones reduced temperatures directly under the mulch by 8-16?C and by 4-5?C in the row themselves. Although surface soil in the rows of both treatments became very dry, the soil around the seed and seedling roots was close to field capacity. Bulrush millet established well on both mulch and unmulched treatments. Sorghum emerged 3-4 days earlier on the mulched plots and the stand was approximately double that on control plots. Without mulch, maize suffered extremely high mortality; surviving seedlings had an intense heat-stress lesion (Lal 1974) and grew slower than with mulch.

TABLE l. Effect of mulch on soil temperature and water potential on a Blain sand at 1500 hrs 13 Jan. 1979. (Screen max. 34?C)

	No mulch				Mulch			
	Inter-row		Row		Inter-row		Row	
Depth (cm)	°C	Bars	°C	Bars	°C	Bars	°C	Bars
1	51	<-40	50	<-40	35	-0.20	46	<-30
5	44	-0.20	44	-0.30	34	-0.18	39	-0.22
10	41	-0.18	40	-0.18	33	-0.10	36	-0.20

A second experiment compared zero-tillage production of maize and sorghum with that of conventional clean cultivation on a sandy clay loam. In the zero-till treatment, seed was planted in slits in pasture carrying l-l.5 t/ha of dry matter which had been killed with glyphosate. Establishment of both maize and sorghum was more than 40 percent greater with zero-tillage. Grain yield of maize was 5.6 t/ha with conventional and 7.l t/ha with zero-tillage. Sorghum grain yields were invalidated by bird damage, but stover yields were 20% higher with zero-tillage.

The potential magnitude of the short-term benefit was almost certainly under-estimated in these studies due to the absence of mulch over the row zone.

Lal, R. (1974). Plant and Soil 40: 321, and 40: 589. LAL, R. (1978). Field Crops Res. l: 127.