

NITROGEN FERTILITY PRACTICES FOR INTERCROPPED CORN-SOYBEAN

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Three previous years of research has shown the potential of an intercrop of corn and soybean to produce forage yields similar to those from corn alone but with improved quality from the intercrop. The main focus of these studies had been on plant densities and planting patterns. The corn-soybean combination, where every second row of corn was replaced by two rows of soybeans, was found to produce the greatest yields of forage, however the corn-corn-soybean-soybean intercrop pattern resulted in more soybean in the forage mixture. Also this research showed that corn rows in intercrops need to be planted at double the rate of corn rows in monoculture. This is still the same overall density of corn, since there are half as many rows.

In 1983, two experiments were established to examine the possibilities for nitrogen economy with an intercrop. The reasoning for this is that soybean being a legume is capable of fixing atmospheric nitrogen when properly nodulated, and so is less dependent for growth on sources of nitrogen from the soil. For these studies the corn-corn-soybean-soybean intercrop pattern was chosen to ensure in certain treatments that nitrogen fertilizer was only applied to corn, that is between neighboring corn rows.

Table 1 shows silage yields from the various nitrogen application rates for corn and soybean monocultures and intercrops for the experimental sites at the Agricultural Experiment Station Research farm in South Deerfield and the State School farm in Belchertown. For the monocultures and one of the intercrop

Table 1. Effect of nitrogen fertilizer on silage yield of corn (C-C), and soybean (S-S) monocultures and a corn-corn-soybean-soybean intercrop.

Nitrogen Fertilizer	C-C		S-S		C-C-S-S		C-C-S-S†			
	S.D.	Belch.	S.D.	Belch.	S.D.	Belch.	S.D.	Belch.		
kg/ha					t/ha					
0	20.0	44.8	26.0	11.6	30.6	20.1	40.4	25.5	-	-
45	-	-	-	-	-	-	-	-	48.9	32.8
90	23.5	52.7 ⁹²	38.4	17.1	30.4	25.3	47.6	30.1	60.5	41.4
180	29.0	65.1 ⁹²	44.4	19.8	29.3	28.2	51.1	35.4	45.6	30.8
	22.2	49.8	33.5	14.9						

† Nitrogen fertilizer was only applied between corn rows, thus the effective rate is doubled for corn.

patterns after a basal application of 15 kg/ha of nitrogen the nitrogen treatments of 0, 90, 180 kg/ha (approx. 0, 100, 200 lb/ac) were topdressed over the corn in mid-June 1983. The remaining intercrop treatment had 3 rates of nitrogen (45, 90, 180 kg/ha) applied only between the corn rows, thus the effective rates available to these corn rows were 90, 180 and 360 kg/ha, since the soybean occupying half the cropped area received zero nitrogen.

Forage yields in all treatments were greater for the South Deerfield site compared to equivalent treatments in Belchertown. However, even though one site was more productive than the other mostly the yield trends were similar at both sites. As found in other studies corn monoculture yields were about twice those of soybeans grown alone. Corn monoculture yields increased as nitrogen rates increased at both sites. In South Deerfield soybean monoculture yields did not respond to increasing rates of nitrogen, while in Belchertown increasing nitrogen increased soybean yields. The South Deerfield site has had a history of growing soybeans and thus soybean plants may have been better nodulated and more able to fix nitrogen than soybean plants in Belchertown where soybeans were being grown for the first time. Topdressing nitrogen across both corn and soybean increased the yield of the intercrop, however applying nitrogen to only the corn rows was more efficient. In this latter treatment 90 kg/ha of nitrogen produced a yield 27-38% greater than the intercrop where the same nitrogen was applied to both the corn and soybean and yielded 8-15% more than corn monoculture for the same expenditure of nitrogen. In this intercrop, where 90 kg/ha of nitrogen was applied to only the corn rows, the forage yielded 93% of the yield of corn monoculture which received 180 kg/ha of nitrogen. This intercrop treatment also showed that excessive applications of nitrogen (in this case ammonium nitrate) the 180 kg/ha rate (360 kg/ha effective rate for corn) can be damaging to the crop.

Earcorn yields shown in Table 2 followed mostly the same trends as found for silage yields. Bushel yields of corn per acre, which also followed a similar trend, are shown in Table 3.

Table 2. Effect of nitrogen fertilizer on earcorn yield of corn (C-C), and a corn-corn-soybean-soybean intercrop.

Nitrogen Fertilizer	C-C		C-C-S-S				C-C-S-S†					
	S.D.	Belch.	S.D.	Belch.	S.D.	Belch.	S.D.	Belch.				
	kg/ha											
0	2024	5014	2839	1,27	3201	2855	1161	1036	-	-		
45	-	-	-	-	-	-	-	-	5275	4705	2667	2379
90	2,83	6339	83	5337	2,38	5353	2344	7181	6405	4702	4194	
180	4,12	9227	77	6877	307	6296	3532	4808	4289	2935	2618	
360	354	7924	4813	2,17								

† Nitrogen fertilizer was only applied between corn rows, thus the effective rate is doubled for corn.

Table 3. Effect of nitrogen fertilizer on shelled corn yield and corn (C-C) and a corn-corn-soybean-soybean intercrop.

Nitrogen Fertilizer	C-C		C-C-S-S		C-C-S-S†	
	S.D.	Belch.	S.D.	Belch.	S.D.	Belch.
	bushels/acre					
0	72	41	42	17	-	-
45	-	-	-	-	80	40
90	100	84	83	36	105	71
180	144	104	98	53	74	45

† Nitrogen fertilizer was only applied between corn rows, thus the effective rate is doubled for corn.

Figure 1 shows protein production from monocultures of both crops and intercrops. Soybean produced the greatest yields of protein, but these were equalled or surpassed by the best intercrop treatment with 90 kg/ha of nitrogen all applied to the corn rows. Normally well nodulated soybean would not be fertilized with nitrogen, since the yield response is usually that found in South Deerfield. Thus in Belchertown the intercrops yielded more protein per acre when compared to the soybean with zero nitrogen above the basal rate. For corn monoculture nitrogen applications improved protein yield. However intercrops with nitrogen all applied to corn rows was more efficient, producing more protein with less nitrogen applied.

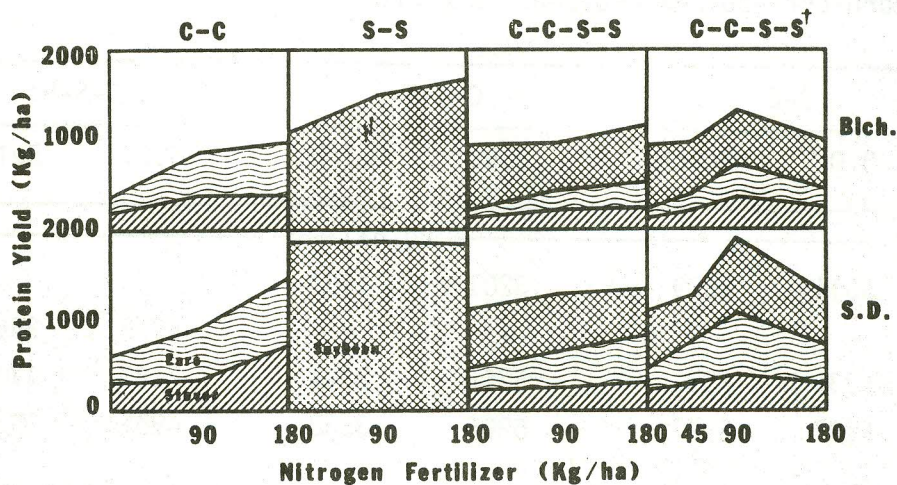


Figure 1. Effect of nitrogen fertilizer on protein yield of corn (C-C) and soybean (S-S) monocultures and a corn-corn-soybean-soybean intercrop where nitrogen was applied to both corn and soybean (C-C-S-S) and only corn (C-C-S-S†).