Table 5.7 Over-year parameter estimates for fitted dose response curves - *S. nodorum* glume blotch on the ear

Product	Parameter estimates					
	a	b	k	a + b	a + be^k	Mean R^2 adjusted
Alto	17.1	4.9	-15.9	22.05	17.1	-49.9
Opus	5.2	16.8	-5.0	22.05	5.3	93.7
Bravo	8.7	13.4	-3.3	22.05	9.2	-8.7
Folicur	8.6	13.5	-4.5	22.05	8.7	75.5
Pointer	5.4	16.6	-4.4	22.05	5.6	96.8
Sanction	7.5	14.5	-2.5	22.05	8.7	46.2
Tilt	22.8	-0.7	2.9	22.05	9.5	93.9
Unix	7.3	14.8	-3.0	22.05	8.0	92.9
Amistar	7.0	15.0	-8.4	22.05	7.0	59.9
Ensign	8.6	13.4	-4.6	22.05	8.8	-23.3
Caramba	7.2	14.8	-2.9	22.05	8.0	40.8
Landmark	6.3	15.8	-8.9	22.05	6.3	-0.5
Sportak	8.8	13.2	-3.8	22.05	9.1	98.4

5.2.4 Grain yield

Untreated yields were low in each year of the experiment. In 1997 (Table 5.8; Figure 5.8), they averaged just 2.17 tonne/ha, and while all fungicides increased yield, only Landmark achieved 5 tonne/ha at full dose, giving it a 0.2 tonne/ha advantage over Opus. Caramba, Folicur and Amistar all had similar dose-response curves, with k values of -2.0 - -2.1 and full dose yields from 4.5 - 4.8 tonne/ha. Bravo and Ensign both gave lower yields, 3.2 tonne/ha at full dose and Unix again showed little response from increasing dose above a quarter. Sanction again had a positive k value giving very little increase in yield at a quarter dose and a relatively large increase when dose was increased from three-quarters to full.

Table 5.8 Parameter estimates for fitted dose response curves - Yield

Product	Parameter estimates					
	a	b	k	a + b	a + be^k	Mean R^2 adjusted
Opus	5.0	-2.9	-2.6	2.16	4.8	84.8
Bravo	3.6	-1.4	-2.2	2.16	3.4	75.9
Folicur	4.9	-2.8	-2.0	2.16	4.6	97.0
Sanction	1.8	0.4	1.7	2.16	3.9	93.4
Unix	3.7	-1.5	-5.0	2.16	3.7	65.0
Amistar	4.9	-2.7	-2.1	2.16	4.5	91.0
Ensign	3.7	-1.5	-1.4	2.16	3.3	96.6
Caramba	5.2	-3.0	-2.0	2.16	4.8	85.6
Landmark	5.4	-3.2	-2.2	2.16	5.0	83.3

<u>5.2.5 Grain quality</u>

The shape of the dose-response curves for each fungicide for specific weight of grain (Figure 5.9; Table 5.9) reflect the yield curves.

Table 5.9 Parameter estimates for fitted dose response curves - specific weight

Product	Parameter estimates					
	a	b	k	a + b	$a + be^k$	Mean R^2 adjusted
Opus	67.5	-10.4	-2.2	57.1	66.3	94.2
Bravo	63.6	-6.6	-1.5	57.1	62.2	78.8
Folicur	64.3	-7.2	-3.7	57.1	64.1	86.1
Sanction	56.5	0.6	2.4	57.1	62.8	92.6
Unix	62.2	-5.1	-5.9	57.1	62.2	59.9
Amistar	64.9	-7.8	-2.6	57.1	64.3	83.0
Ensign	60.4	-3.3	-2.1	57.1	60.0	84.3
Caramba	67.1	-10.0	-2.2	57.1	65.9	89.0
Landmark	65.0	-7.8	-4.1	57.1	64.8	79.0

Figure 5.5 Dose-response curves for foliar *S. nodorum* - overall means

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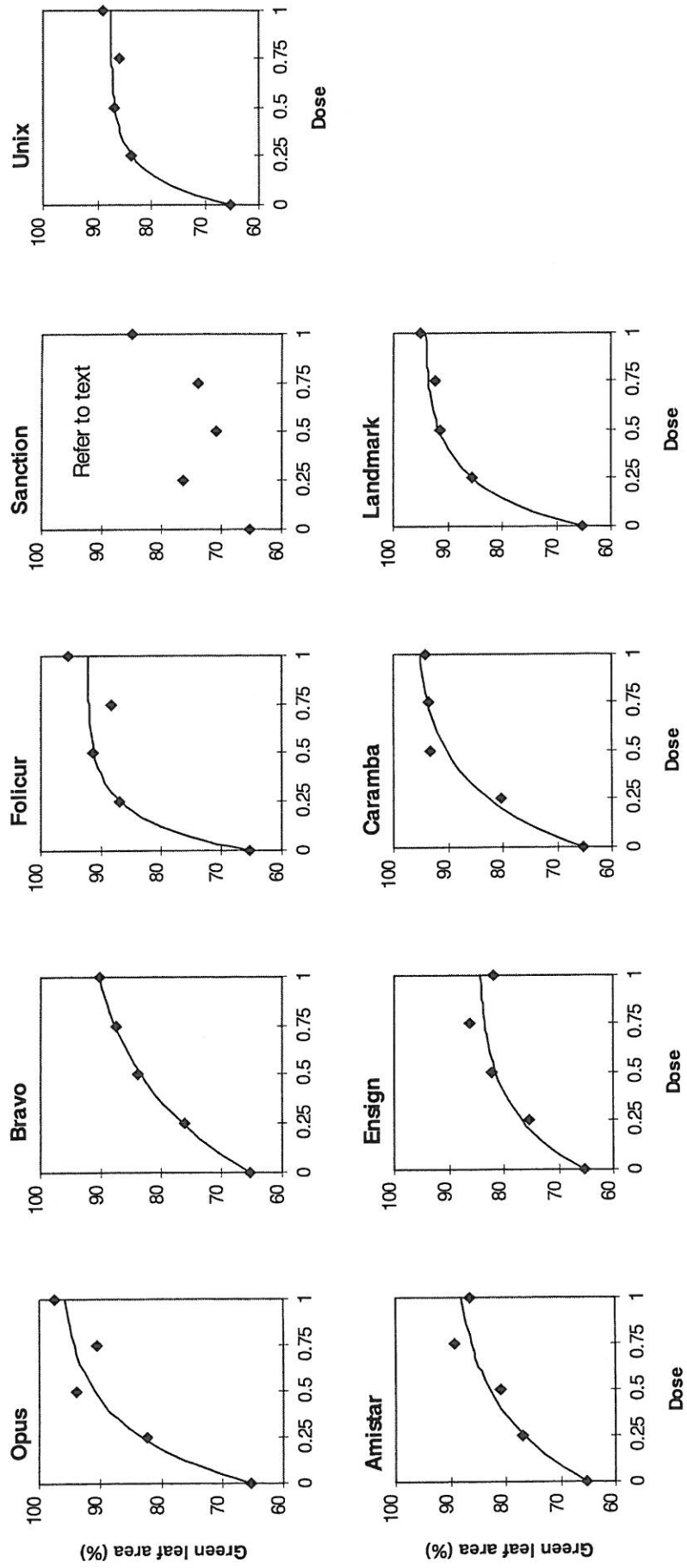**Figure 5.6** Dose-response curves for green leaf area in *S. nodorum* experiments - overall means

Figure 5.7 Dose-response curves for *S. nodorum* glume blotch on the ear - overall means
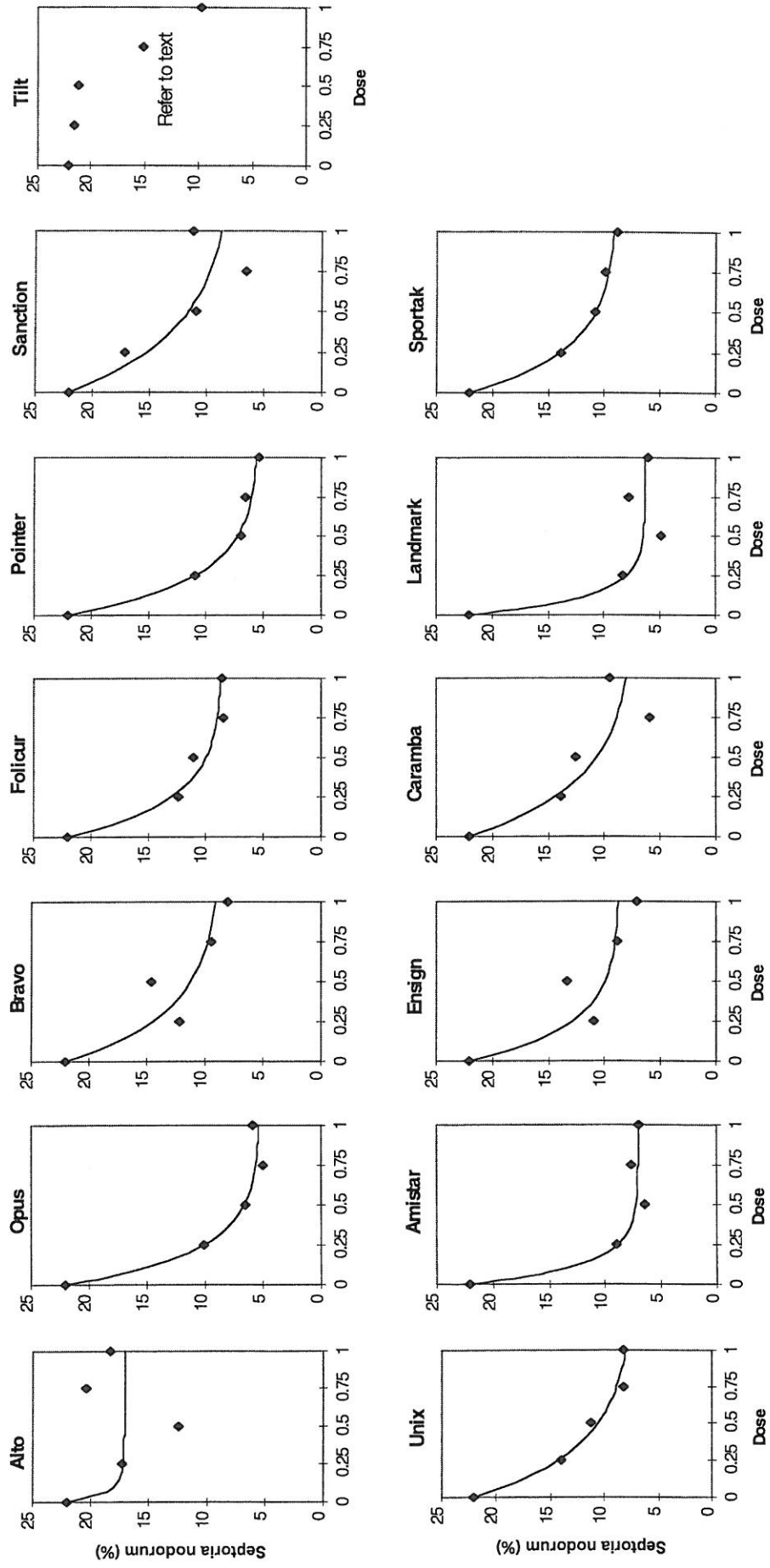

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Figure 5.8 Dose-response curves for grain yield in *S. nodorum* 1997 experiment
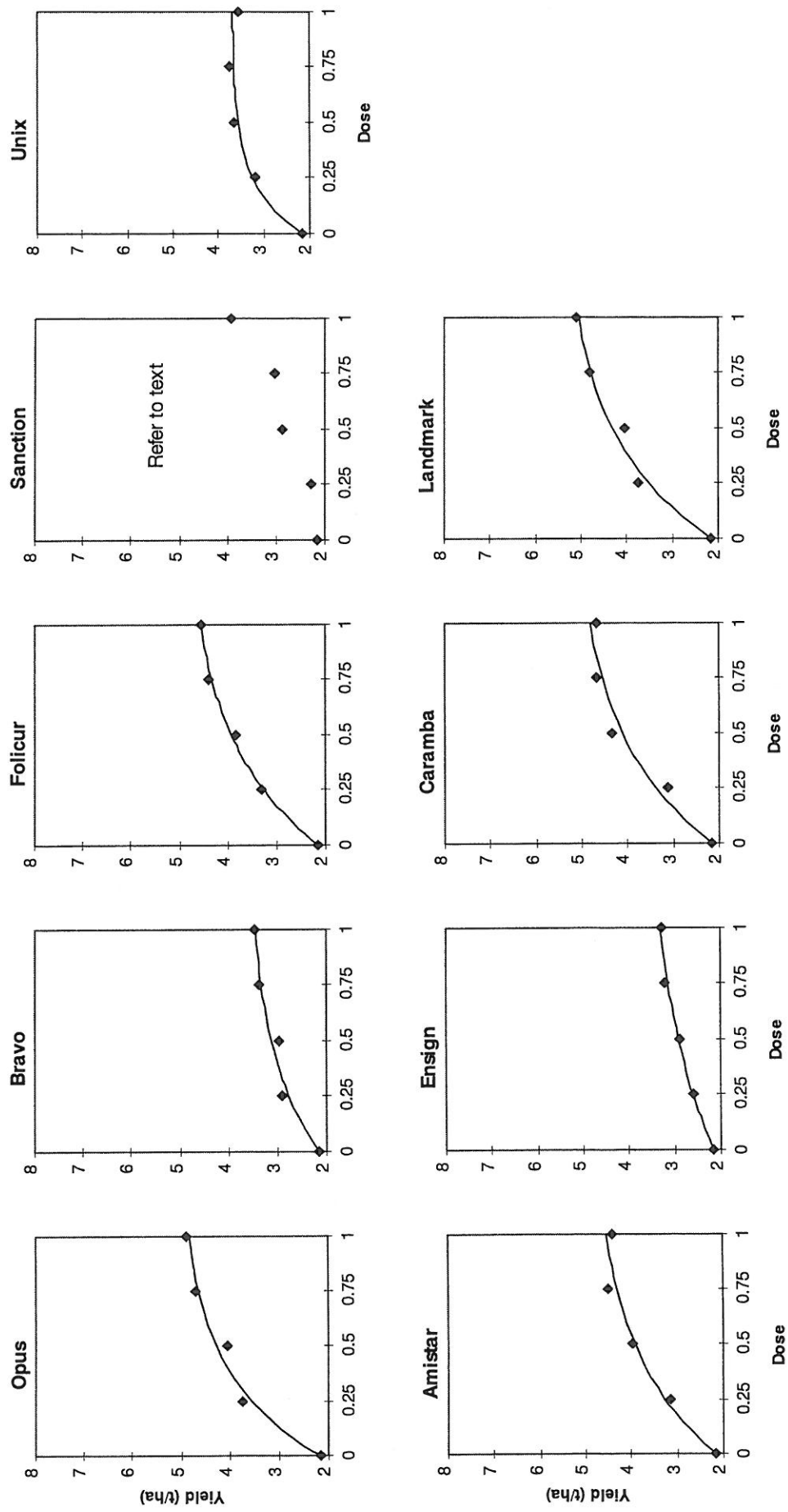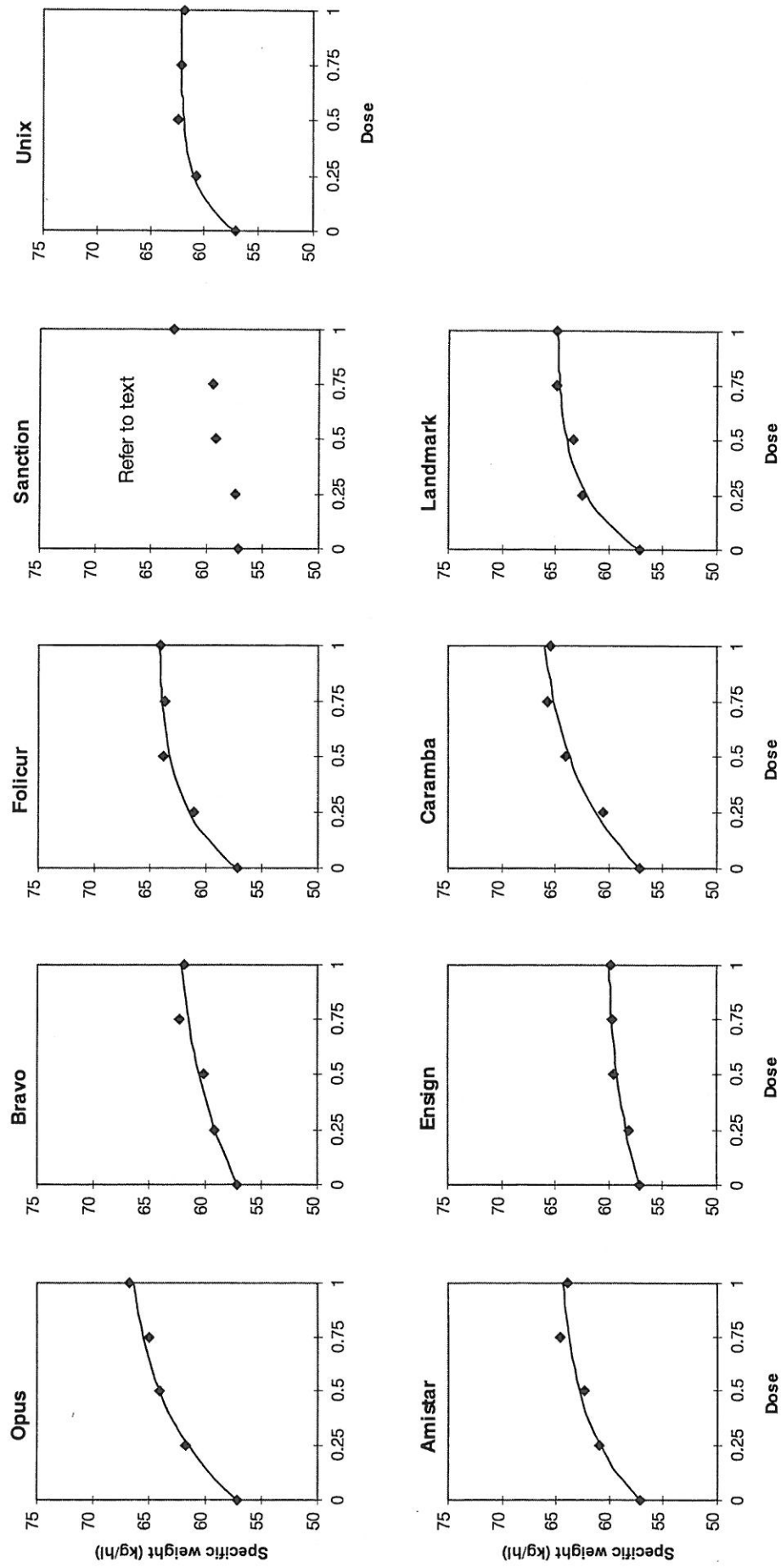

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Figure 5.9 Dose-response curves for specific grain weight in *S. nodorum* 1997 experiment

5.3 Brown rust experiments

5.3.1 Disease control

A late epidemic of brown rust occurred in East Anglia in 1998. Dose-response curves describing the activity of fungicides against brown rust, derived from over-assessment means, are shown in Figure 5.10. The parameter estimates given in Table 5.10 describe the curves quantitatively. The R^2 values suggest that the exponential dose-response function provided a generally good description of the data.

The relative performance of products did not differ significantly between eradicant and protectant situations. The absence of an eradicant/protectant by product interaction allowed data to be combined. So, the data shown represent a range of situations, from treatments which were applied before infections had become established, to those applied to well established infections at the limit of eradicant activity.

The most effective control was provided by the triazole and triazole based mixture treatments. Corbel provided useful control alone and in formulated mixture with Opus as Opus Team.. Amistar, Ensign and Neon provided a useful level of control. Unix and Fortress were included in the experiment to assess their mildew activity, they provided insufficient control of brown rust to allow dose-response curves to be fitted.

Table 5.10 Cross site parameter estimates for fitted dose response curves - brown rust area, combined eradicant/protectant.

Product	Parameter estimates					
	a	b	k	a + b	$a + be^k$	Mean R^2 adjusted
Alto	7.5	37.1	-3.8	44.58	8.4	95.1
Opus	7.7	36.8	-6.6	44.58	7.8	97.2
Corbel	14.5	30.1	-6.9	44.58	14.5	90.5
Folicur	8.8	35.8	-7.0	44.58	8.8	53.1
Patrol	51.0	-6.4	1.4	44.58	23.8	61.3
Unix	Data not fitted					
Amistar	14.8	29.8	-2.5	44.58	17.2	22.1
Ensign	-17.2	61.6	-0.6	44.58	15.2	72.4
Fortress	Data not fitted					
Opus team	4.4	40.2	-8.1	44.58	4.4	56.1
Amistar+Corbel	9.3	35.2	-4.6	44.58	9.7	92.9
Neon	18.6	26.0	-3.2	44.58	19.6	85.9
Caramba	11.8	32.8	-5.1	44.58	12.0	80.3
Landmark	6.4	38.1	-7.3	44.58	6.5	75.7

5.3.2 Green leaf area

Severe brown rust symptoms are associated with rapid loss of green leaf area due to necrosis surrounding the rust pustules. This is reflected in the green leaf area data (Figure 5.11; Table 5.11), where the relative performance of products in controlling symptom expression was confirmed

Table 5.11 Cross-site parameter estimates for fitted dose response curves - green leaf area, combined eradicant/protectant.

Product	Parameter estimates					
	a	b	k	a + b	$a + be^k$	Mean R^2 adjusted
Alto	72.8	-44.5	-3.72	28.29	71.8	91.5
Opus	75.8	-47.5	-5.02	28.29	75.5	93.5
Corbel	63.2	-34.9	-4.73	28.29	62.9	77.4
Folicur	71.1	-42.8	-6.02	28.29	71.0	59.6
Patrol	197.1	-168.8	-0.18	28.29	56.2	94.4
Unix	Data not fitted					
Amistar	58.3	-30.0	-2.65	28.29	56.2	25.8
Ensign	77.0	-48.7	-1.79	28.29	68.9	72.6
Fortress	20.2	8.1	<-20.00	28.29	20.2	-50.0
Opus team	76.6	-48.3	-6.37	28.29	76.5	70.5
Amistar+Corbel	74.2	-45.9	-2.87	28.29	71.6	83.0
Neon	52.8	-24.5	-3.96	28.29	52.3	88.4
Caramba	67.2	-38.9	-4.58	28.29	66.8	55.2
Landmark	80.1	-51.8	-5.02	28.29	79.7	64.2

5.3.3 Grain yield

Yield benefits from fungicide treatment (Figure 5.12; Table 5.12) were in agreement with the dose-response curves for disease and green leaf area retention, with single sprays of triazole and triazole based mixtures providing yield responses of up to 3.4 t/ha.

The addition of kresoxim-methyl to epoxiconazole as Landmark, gave an additional 1.0 t/ha and 0.6 t/ha over Opus and Opus Team respectively, despite the disease control of the latter being similar or marginally superior to Landmark.

The response curve for Amistar + Corbel was similar to that for Ensign, suggesting that the strobilurin components were exhibiting similar activity.

Overall, the results reinforce the view that strobilurins must be mixed with effective triazoles, if their yield benefits are to be realised.

Table 5.12 Cross site parameter estimates for fitted dose response curves - yield, combined eradicant/protectant.

| Product | Parameter estimates | | | | | |
	a	b	k	a + b	a + be^k	Mean R^2 adjusted
Alto	6.5	-2.6	-3.7	3.92	6.4	96.9
Opus	6.9	-3.0	-3.7	3.92	6.9	91.4
Corbel	5.9	-2.0	-6.3	3.92	5.9	5.3
Folicur	6.6	-2.7	-6.2	3.92	6.6	43.2
Patrol	6.0	-2.1	-2.2	3.92	5.8	99.6
Unix	3.9	0.03	3.0	3.92	4.6	92.3
Amistar	7.8	-3.9	-1.1	3.92	6.5	90.6
Ensign	7.5	-3.6	-1.4	3.92	6.6	96.1
Fortress	2.2	1.7	0.2	3.92	4.3	77.4
Opus team	7.6	-3.7	-2.6	3.92	7.3	84.0
Amistar+Corbel	7.3	-3.3	-1.9	3.92	6.8	70.5
Neon	5.6	-1.7	-2.9	3.92	5.5	96.3
Caramba	6.4	-2.5	-4.1	3.92	6.4	86.5
Landmark	8.0	-4.1	-4.0	3.92	7.9	89.9

5.3.4 Grain quality

Improvements in specific weight reflected yield benefits from treatment (Figure 5.13; Table 5.13).

Table 5.13 Cross site parameter estimates for fitted dose response curves -specific weight, combined eradicant/protectant.

| Product | Parameter estimates | | | | | |
	a	b	k	a + b	a + be^k	Mean R^2 adjusted
Alto	71.3	-6.3	-3.97	65.05	71.2	75.3
Opus	73.4	-8.3	-2.50	65.05	72.7	90.7
Corbel	69.8	-4.8	<-20.00	65.05	69.8	-50.0
Folicur	71.4	-6.3	-11.06	65.05	71.4	-37.6
Patrol	72.6	-7.6	-1.06	65.05	70.0	86.7
Unix	64.0	1.0	<-20.00	65.05	64.0	-50.0
Amistar	73.0	-7.9	-1.82	65.05	71.7	87.9
Ensign	55.1	9.9	0.56	65.05	72.6	90.8
Fortress	64.5	0.5	<-20.00	65.05	64.5	-50.0
Opus team	75.8	-10.7	-2.10	65.05	74.4	83.3
Amistar+Corbel	75.3	-10.2	-1.17	65.05	72.1	90.0
Neon	69.8	-4.7	-1.93	65.05	69.1	87.6
Caramba	70.9	-5.8	-3.70	65.05	70.7	55.4
Landmark	74.6	-9.6	-4.50	65.05	74.5	91.6

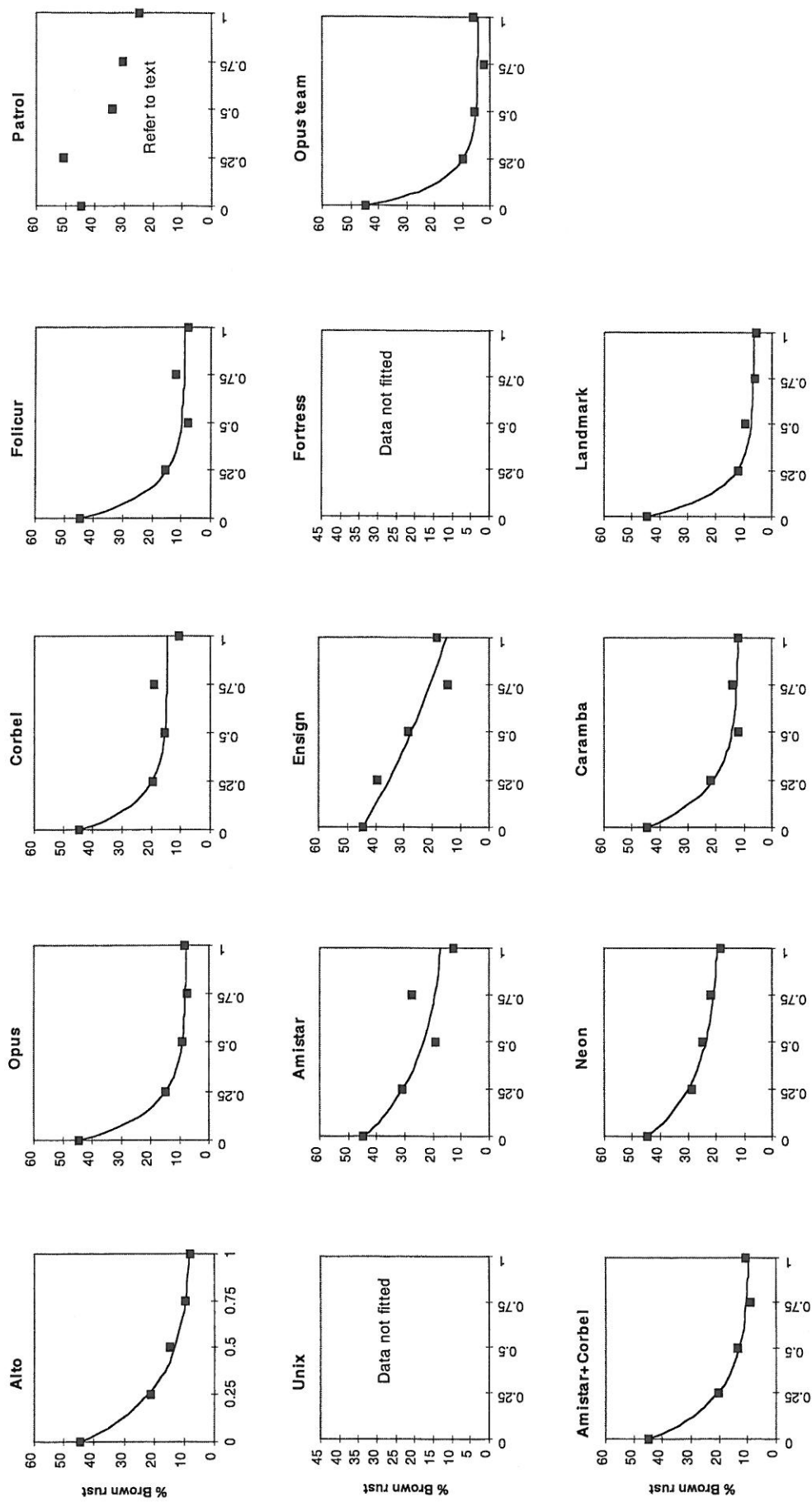**Figure 5.10** Dose-response curves for brown rust - overall means

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Figure 5.11 Dose-response curves for green leaf area in brown rust experiments - overall means
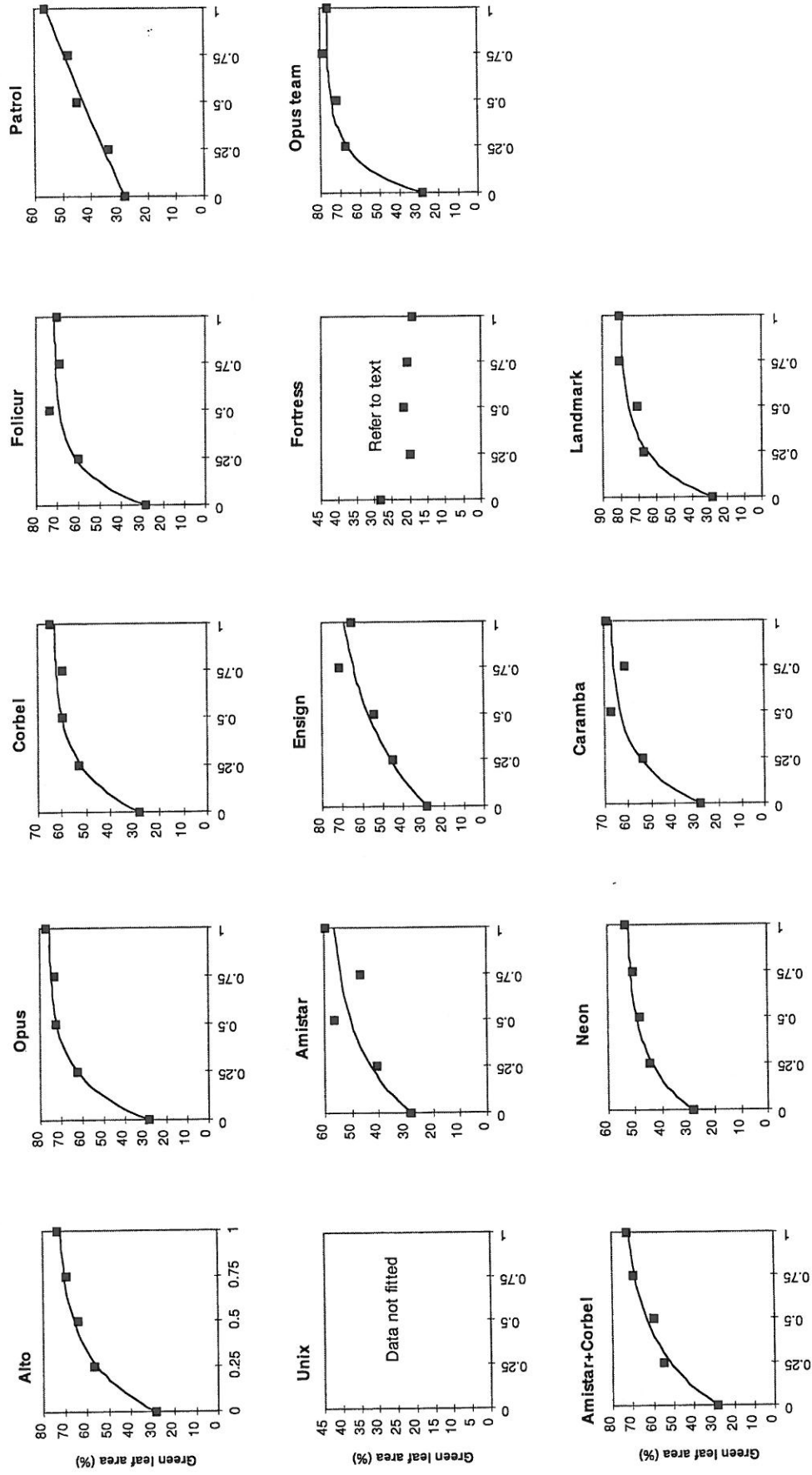
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Figure 5.12 Dose-response curves for grain yield in brown rust experiments - overall means
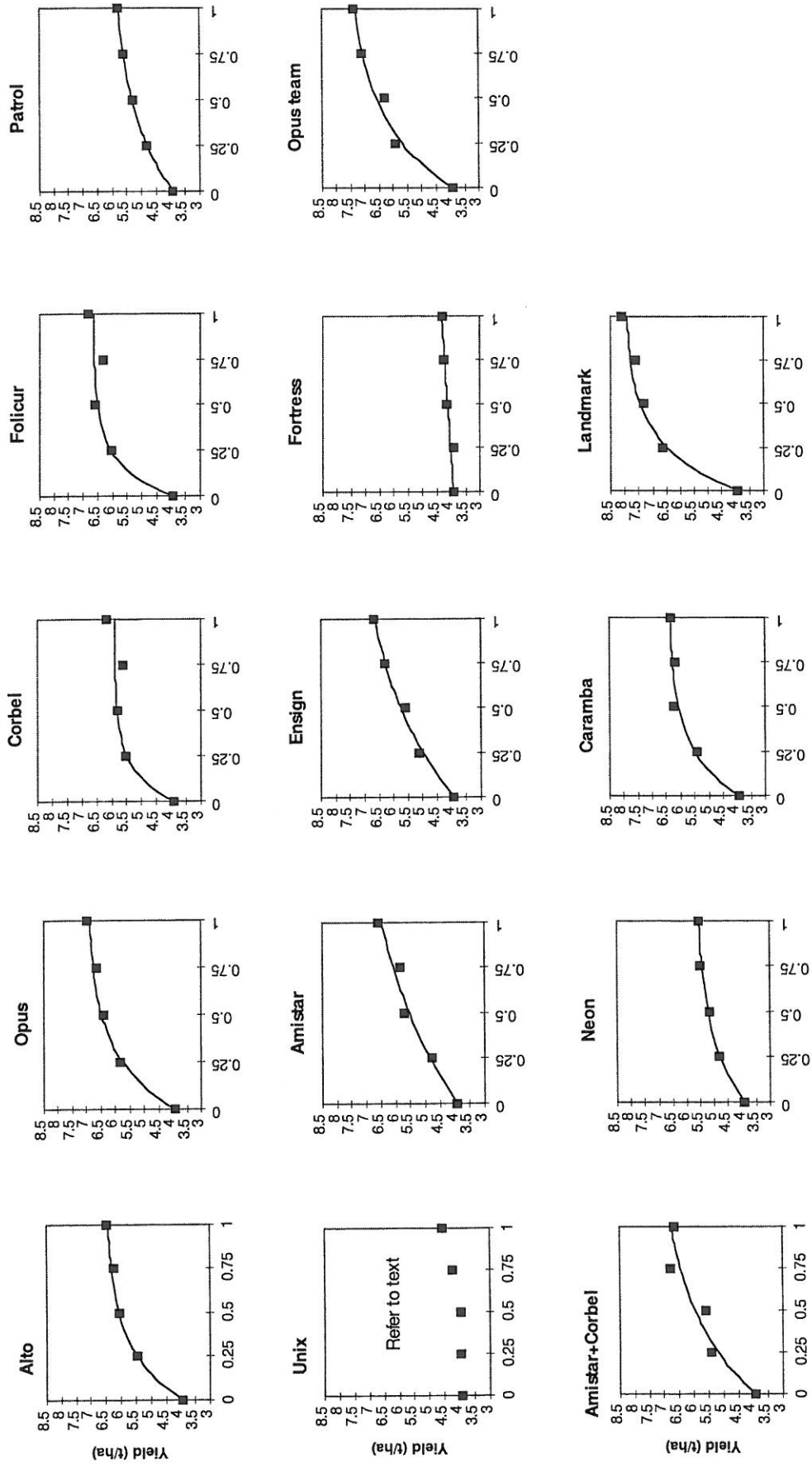
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Figure 5.13 Dose-response curves for specific grain weight in brown rust experiments - overall means

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