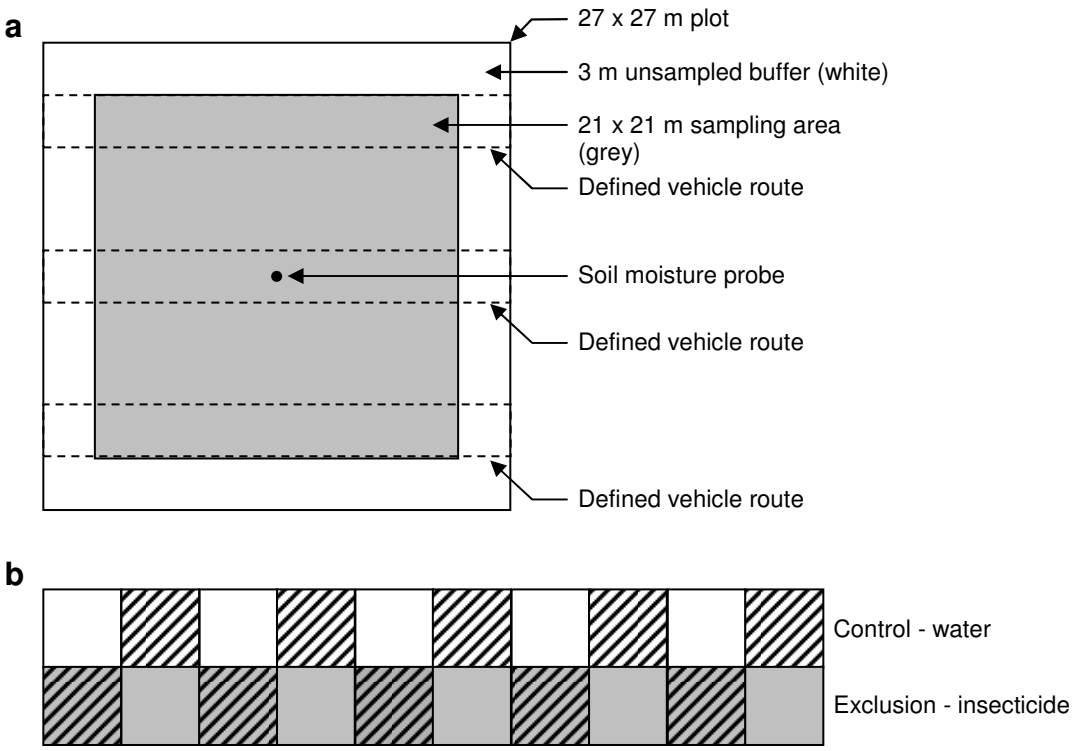
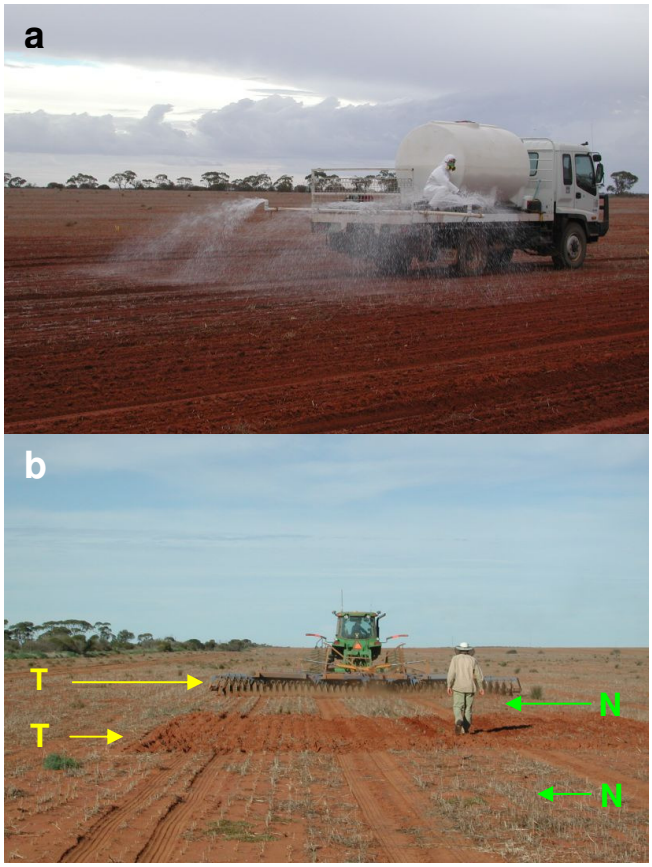
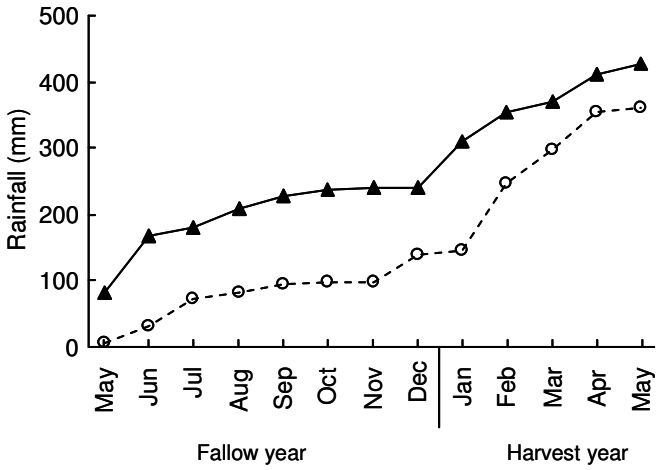
Supplementary Figures



Supplementary Figure S1 | **Schematic of experiment plots**. **(a)** One of the 27 x 27 m plots, crossed by three defined vehicle routes, 'controlled traffic tracks'. **(b)** Plot layout was aligned along the defined vehicle routes to allow insecticide or water application by truck without soil compression. Tillage indicated by cross-hatching.



Supplementary Figure S2 | Installation of the experimental treatments. **(a)** Truck used to spray either the water in the control plots or insecticide in the exclusion plots. **(b)** 'Grizzly' plough used for the tillage treatment; NT = no-till plot, T = tilled plot.



Supplementary Figure S3 | Cumulative rainfall over 12 months prior to seeding. Data pre-2006 cropping season are black triangles with solid line, data from pre-2008 cropping season are white circles with dashed line.

Supplementary Figure S4 | **Assessing insect tunnels in plots**. **(a)** Backhoe digging holes in plots; CT = controlled traffic tracks. **(b)** Counting tunnels in quadrats on wall of hole.

Supplementary Tables

Supplementary Table S1 | Results of repeated measures two-way ANOVA of ant activity pre- and post-exclusion treatment.

Source	SS	df	MS	F	*P*
Pre treatment					
Exclusion	0.200	1	0.200	0.008	0.932
Tillage	5.000	1	5.000	0.190	0.669
Exclusion x Tillage interaction	7.200	1	7.200	0.274	0.608
Error	420.8	16	26.300		
Post treatment					
Exclusion	1312.2	1	1312.2	76.180	<0.001
Tillage	9.800	1	9.800	0.569	0.462
Exclusion x Tillage interaction	7.200	1	7.200	0.418	0.527
Error	275.6	16	17.225		

Supplementary Table S2 | Results of two-way ANOVA of termite activity (proportion of baits contacted) after the exclusion treatment.

Source	SS	df	MS	F	*P*
Exclusion	39.200	1	39.200	13.635	0.002
Tillage	0.200	1	0.200	0.070	0.795
Exclusion x Tillage interaction	0.800	1	0.800	0.278	0.605
Error	46.000	16	2.875		

Supplementary Table S3 | Results of the repeated measures two-way ANOVA for wheat yield from 2006 and 2008

Source	SS	df	MS	F	*P*
Between Subjects					
Exclusion	0.029	1	0.029	5.970	0.027
Tillage	0.003	1	0.003	0.673	0.424
Exclusion x Tillage interaction	0.000	1	0.000	0.003	0.955
Error	0.078	16	0.005		
Within Subjects					
Year	0.275	1	0.275	128.161	<0.001
Year x Exclusion interaction	0.015	1	0.015	7.135	0.017
Year x Tillage interaction	0.008	1	0.008	3.704	0.072
Year x Exclusion x Tillage interaction	0.002	1	0.002	0.754	0.398
Error	0.034	16	0.002		

Supplementary Table S4 | Results of the repeated measures two-way ANOVA for pinched kernels from 2006 and 2008

Source	SS	df	MS	F	*P*
Between Subjects					
Exclusion	0.001	1	0.001	0.192	0.667
Tillage	0.000	1	0.000	0.000	0.989
Exclusion x Tillage interaction	0.000	1	0.000	0.089	0.789
Error	0.078	16	0.005		
Within Subjects					
Year	0.241	1	0.241	61.303	<0.001
Year x Exclusion interaction	0.001	1	0.001	0.159	0.695
Year x Tillage interaction	0.000	1	0.000	0.121	0.732
Year x Exclusion x Tillage interaction	0.001	1	0.001	0.235	0.635
Error	0.063	16	0.004		

Supplementary Table S5 | Results of the separate two-way ANOVAs for wheat yield from 2006 and 2008					
Source	SS	df	MS	F	*P*
2006					
Exclusion	0.001	1	0.001	0.367	0.553
Tillage	0. 001	1	0. 001	0.175	0.681
Exclusion x Tillage interaction	0. 001	1	0. 001	0.224	0.642
Error	0.047	16	0.003		
2008					
Exclusion	0.043	1	0.043	10.620	0.005
Tillage	0. 011	1	0. 011	2.632	0.124
Exclusion x Tillage interaction	0. 001	1	0. 001	0.241	0.630
Error	0.065	16	0.003		

Supplementary Table S6 | Results of the two-way ANOVA for insect tunnels from 2008

Source	SS	df	MS	F	*p*
Exclusion	1.966	1	1.966	12.457	0.003
Tillage	0.279	1	0.279	1.769	0.202
Exclusion x Tillage interaction	0.094	1	0.094	0.597	0.451
Error	2.525	16	0.158		

Supplementary Table S7 | Results of the two-way ANOVA on soil water at 0.5 m depth from 2006 and 2008

Source	SS	df	MS	F	*p*
2006					
Exclusion	0.043	1	0.043	0.174	0.684
Tillage	0.455	1	0.455	1.849	0.199
Exclusion x Tillage interaction	0.535	1	0.535	2.174	0.166
Error	2.953	12	0.246		
2008					
Exclusion	2.768	1	2.768	10.26	0.008
Tillage	0.000	1	0.000	0.001	0.977
Exclusion x Tillage interaction	0.005	1	0.005	0.019	0.892
Error	3.237	12	0.270		

Supplementary Table S8 | The results of the repeated measures two-way ANOVA for available soil nitrogen from 2006 and 2008

Source	SS	df	MS	F	*p*
Between Subjects					
Exclusion	0.225	1	0.225	1.184	0.293
Tillage	0.002	1	0.002	0.008	0.928
Exclusion x Tillage interaction	0.031	1	0.031	0.142	0.711
Error	3.441	16	0.215		
Within Subjects					
Year	11.801	1	11.801	39.851	<0.001
Year x Exclusion interaction	3.792	1	3.792	12.805	0.003
Year x Tillage interaction	0.028	1	0.028	0.094	0.764
Year x Exclusion x Tillage interaction	0.026	1	0.026	0.089	0.764
Error	4.738	16	0.296		

Supplementary Table S9 | The results for the separate two-way ANOVAs for available soil nitrogen from 2006 and 2008

Source	SS	df	MS	F	*p*
2006					
Exclusion	1.041	1	1.041	3.348	0.086
Tillage	0. 022	1	0. 022	0.070	0.794
Exclusion x Tillage interaction	0. 057	1	0. 057	0.183	0.674
Error	4.972	16	0.003		
2008					
Exclusion	3.006	1	3.006	14.999	0.001
Tillage	0. 008	1	0. 008	0.038	0.847
Exclusion x Tillage interaction	0. 000	1	0. 000	0.000	0.985
Error	3.207	16	0.200		

Supplementary Methods

Experiment installation

We determined plot size based in part on the farm management practice of defined vehicle routes and in part of foraging behaviour. The defined vehicle routes across the fields were nine metres apart. Therefore we made plots three tracks wide and an equivalent distance long, 27 m x 27 m; with an area of 729 m^2. This distance was considered to be larger than the likely foraging distances of the ant and termite species present in the paddock[61,62]. We considered the outer 3 m as a buffer zone; and we sampled only the inner 21 m x 21 m (441 m^2) (Supplementary Figure S1).

We installed the experimental treatments from 11 to 22 May 2006. We applied the insecticidal solution to the exclusion plots and water to the control plots using a truck with water tank and PVC pipe rigging adapted to spray water (Supplementary Figure S2a). We applied the shallow tillage, equivalent to mechanical weeding, using a Grizzly 92, Sandgroper two-way tandem disc plough. For no-tillage the plough was lifted above the soil when the tractor crossed the plot (Supplementary Figure S2b).

We used rainfall data from nearby weather stations operated by Australian Bureau of Meteorology to calculate rainfall on the paddock before we began the trial and installed our own rain gauge. We used these data along with our own rain data to calculate cumulative rain available to the wheat 12 months prior to sowing (Supplementary Figure S3).

We counted insect tunnels in pits (2 m long x 1 m wide x 2 m deep) dug with a back hoe (Supplementary Figure S4a). Data were recorded from quadrats (10cm x 10 cm) placed on the vertical side wall of each hole, between 10 and 50 cm deep (the sandy soil 0-10 cm deep was too dry, crumbled rapidly, and so we could not count tunnels). We recorded data from 15 to 30 quadrats on either side of the hole, depending on the condition of the soil (Supplementary Figure S4b).

Effect of exclusion.

We measured the effect of the exclusion by monitoring ant nests and termite foraging activity. We analysed the number of active ant nests data using repeated measures two-way ANOVA (Supplementary Table S1). We analysed the termite bait data using two-way ANOVA (Supplementary Table S2).

Crop yield

The farmer used the same wheat variety ('Bonnie Rock')[63] in 2006 and 2008 at the same rate of 50kg seed / ha, and with the same rate of fertilizer (di-ammonium phosphate compound) 50 kg / ha. We converted the raw data (grain weight g / m) to yield (grain weight t / ha). We analysed yield in a repeated measures two-way ANOVA with log transformed data (to improve homogeneity of variances) (Supplementary Table S3. We analyzed the percentage of pinched kernel data using a repeated measures two-way ANOVA with arc-sine square-root transformed data (to improve homogeneity of variances) (Supplementary Table S4). Because the time and exclusion interaction was

significant in the repeated measures two-way ANOVA for wheat yield, the data from each year were analysed separately with two-way ANOVAs (Supplementary Table S5).

Insect tunnels

We analysed data using a one-way ANOVA on log transformed data (to improve homogeneity of variance) (Supplementary Table S6).

Water infiltration

We analysed increases in soil water at a depth of 0.5 m for two rain events using two-way ANOVAs, one for each year (Supplementary Table S7). We chose the maximum depth of 0.5 m because we considered this to be the best test of infiltration into the soil.

Soil mineral nitrogen

We sampled soil with augers, either manual or automatic, (diameter 5 cm) to 0.5 m depth at harvest in 2006 and 2008. Soil from 0 to 10 cm deep was analysed for mineral nitrogen content. We analysed available mineral nitrogen in a repeated measures two-way ANOVA with log transformed data (to improve homogeneity of variance) (Supplementary Table S8). Because the time and exclusion interaction was significant, we analysed the data from each year separately with two-way ANOVAs (Supplementary Table S9).

Supplementary References

61. Shattuck, S. Australian ants: their biology and identification. (CSIRO, Melbourne, 1999)

62. Hill, G.R. Termites (Isoptera) of the Australian region. (CSIR, Melbourne, 1942).

63. Penny, S. & Curtis, B. EGA Bonnie Rock – a high yielding Australian Hard wheat particularly suited to Agzones 1 and 4. Farmnote 23/2005, Western Australian Department of Agricultural (2005).