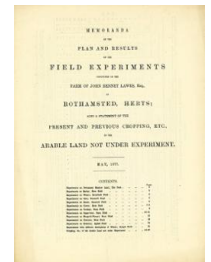


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Memoranda of the Field Experiments at Rothamsted: May 1877



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MEMORANDA
OF THE
PLAN AND RESULTS
OF THE
FIELD EXPERIMENTS
CONDUCTED ON THE
FARM OF JOHN BENNET LAWES, Esq.,
AT
ROTHAMSTED, HERTS;
ALSO A STATEMENT OF THE
PRESENT AND PREVIOUS CROPPING, ETC.,
OF THE
ARABLE LAND NOT UNDER EXPERIMENT.

MAY, 1877.

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THE PARK.

EXPERIMENTS WITH DIFFERENT MANURES ON PERMANENT MEADOW LAND.

The Land has probably been laid down with Grass for some centuries. No fresh seed has been artificially sown within the last 40 years certainly; nor is there record of any having been sown since the Grass was first laid down. The experiments commenced in 1856, at which time the character of the herbage appeared uniform over all the Plots. Excepting as explained in the Table and in the foot-notes, the same description of Manure has been applied year after year to the same Plot.

(Area under experiment, about 7 acres.)

PLOTS.	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	Plots.	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	PRODUCE PER ACRE, WEIGHED AS HAY.										Twenty- first Season, 1876.
				Twentieth Season, 1875 (75)										
				Average per Annum.										
				10 Years, 1866-75. (75)	20 Years, 1866-75. (75)	First Crop.	Second Crop.	Total.						
				Manures, per acre, per Annum.										
				1856-63, 8 years, 14 tons Farmyard Manure, and 200 lbs. Ammonia-salts (a); average produce 49½ cwt. } 1864 and since, 200 lbs. Ammonia-salts alone; average produce (12 years, 1864-75) 38½ cwt. }										
				1856-63, 8 years, 14 tons Farmyard Manure; average produce 42½ cwt. } 1864 and since, unmanured; average produce (12 years, 1864-75) 32½ cwt. }										
				Unmanured, continuously										
				3½ cwt. Superphosphate of Lime (a)										
				3½ cwt. Superphosphate of Lime, and 400 lbs. Ammonia-salts										
				400 lbs. Ammonia-salts										
				1856-68, 13 years, 400 lbs. Ammonia-salts; average produce 30½ cwt. } 1869 and since, 300 lbs. Sulph. Potash, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Magnesia, 3½ cwt. Superphos.; av. prod. (7 yrs., 1869-75) 31½ cwt. }										
				300 lbs. Sulphate Potash, 100 lbs. (a) Sulphate Soda, 100 lbs. Sulph. Magnesia, and 3½ cwt. Superphosphate										
				1856-61, 6 years, 300 lbs. Sulph. Potash, 200 lbs. Sulph. Soda, 100 lbs. Sulph. Magnesia, and 3½ cwt. Superphosphate; average produce 36 cwt. } 1862 and since, 250 lbs. (a) Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3½ cwt. Superphosphate; average produce (14 years, 1862-75) 27½ cwt. }										
				300 lbs. Sulphate Potash, 100 lbs. (a) Sulphate Soda, 100 lbs. Sulphate Magnesia, and 400 lbs. Ammonia-salts										
				1856-61, 6 yrs. 300 lbs. Sulph. Potash, 200 lbs. Sulph. Soda, 100 lbs. Sulph. Magnesia, 3½ cwt. Superphosphate, and 400 lbs. Ammonia-salts; av. prod. 55½ cwt. } 1862 and since, 250 lbs. (a) Sulph. Soda, 100 lbs. Sulph. Magnesia, 3½ cwt. Superphos., 400 lbs. Amm.-salts; av. prod. 54½ cwt. }										
				300 lbs. Sulph. Potash, 100 lbs. (a) Sulph. Soda, 100 lbs. Sulph. Magnesia, 3½ cwt. Superphos., 400 lbs. Amm.-salts; av. prod. (14 yrs., 1862-75) 42½ cwt. }										
				300 lbs. Sulph. Potash, 100 lbs. (a) Sulph. Soda, 100 lbs. Sulph. Magnesia, 3½ cwt. Superphosph., 800 lbs. (a) Ammonia-salts and 400 lbs. Silicate Soda (a)										
				Unmanured continuously										
				300 lbs. Sulphate Potash, 100 lbs. (a) Sulph. Soda, 100 lbs. Sulph. Magnesia, 3½ cwt. Superphosph., 400 lbs. Ammonia-salts, 2000 lbs. Ort Wheat-straw										
				550 lbs. Nitrate of Soda (a), 300 lbs. Sulphate Potash, 100 lbs. Sulphate Magnesia, and 3½ cwt. Superphosphate										
				1858-75, 18 years, 550 lbs. Nitrate Soda										
				1876, and since, 300 lbs. Sulphate Potash, 100 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3½ cwt. Superphosphate										
				275 lbs. Nitrate of Soda, 300 lbs. Sulphate Potash, 100 lbs. (a) Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3½ cwt. Superphosphate										
				275 lbs. Nitrate of Soda										
				Mixture supplying the quantity of Potash, Soda, Lime, Magnesia, Phosphoric acid, Silica, and Nitrogen, contained in 1 ton of Hay (commencing 1865)										
				275 lbs. Nitrate of Soda, 290 lbs. Sulphate of Potash, and 3½ cwt. Superphosphate (commencing 1872)										
				327 lbs. Nitrate of Potash, and 3½ cwt. Superphosphate (commencing 1872)										

(1) "Ammonia-salts" in all cases equal parts Sulphate and Muriate of Ammonia of Commerce.
 (2) The "Superphosphate of Lime" is, in all cases, made from 200 lbs. Bone-ash, 150 lbs. Sulphuric Acid, Sp. Gr. 1.7 (and water).
 (3) Plots 6, 8, and 10, laid, besides the Manures specified, 2000 lbs. Sawdust per acre per annum for the first 7 years, 1856-1862, but without effect.
 (4) 200 lbs. in 1856-63 inclusive.
 (5) 500 lbs. in 1862 and 1863.
 (6) Only 400 lbs. in 1859-60-61.
 (7) The application of Silicates did not commence until 1862.
 (8) 550 lbs. Nitrate of Soda is reckoned to contain the same amount of Nitrogen as 400 lbs. of "Ammonia-salts."

(9) The manures specified were first applied in 1859 (previously, 1856-7 and 8, Sawdust only).
 (10) Averages of 8 years, 10 years, and 18 years, as these experiments did not commence until 1858.
 (11) Averages of (1 year), 10 years, and 11 years, as the experiment only commenced in 1865.
 (12) Averages of 4 years only, 1872-75.
 (13) In previous years the second crop has either been fed off by sheep, without other food, or mown and left on the ground; but in the twentieth season, 1875, it was so unusually heavy, that it was cut, weighed as hay, and removed.
 (14) The second crop of the twentieth season (1875) is not included in these averages, as in all other years the first crop only was weighed and removed.

(Area under experiment, about $4\frac{1}{4}$ acres.)

1 acre	0.40 Hectare	..	..	or 1.59 Prussian Morgen.
1 bushel	0.36 Hectolitre	..	..	or 0.86 Prussian Scheffel.
1 lb. (tund avoird.)	(about)	..	..	..
1 cwt. (hundredweight)	(about)	..	..	or 0.91 Zollverein Pfund.
1 bushel per acre	51.0 Kilogramme	..	..	or 1.02 Centner.
1 bushel per acre	0.9 Hectolitre per Hectare	..	..	or 0.42 Fr. Scheffel per Fr. Morgen.
1 lb. per acre	1.12 Kilogramme per Hectare	..	..	or 0.57 Zollv. Pfd. per Fr. Morgen.
1 cwt. per acre	125.5 Kilogramme per Hectare	..	..	or 0.64 Centner per Fr. Morgen.

acid sp. gr. 1.7 (and water), Sulphuric is, in all cases, made from 200 lbs. Bone-ash, 150 lbs. excepting the addition of the Silicates, have been, and are, in other resorts, mentioned in the above work at 41.

acid sp. gr. 1.7 (and water), Sulphuric is, in all cases, made from 200 lbs. Bone-ash, 150 lbs. excepting the addition of the Silicates, have been, and are, in other resorts, mentioned in the above work at 41.

(2) 300 lbs. per annum for the first six years, 1852-7.
 (3) 900 lbs. per annum for each year thereafter.

[illegible]

(^a) First 6 years, 1852-7, instead of Nitrate of Soda, 400 lbs. Ammonia-salts per annum; next 10 years, 1858-67, 200 lbs. Ammonia-salts per annum; 1908-1913, 100 lbs. Ammonia-salts per annum.

(^b) 550 lbs. Nitrate of Soda for 1853-4, 5-6, and 7, and 975 lbs. year (1862); Nitrate alone each year since.

(iv) Ammonia-salts also the first year, but not since. 275 lbs.

() The application of Silicates did not commence until 1864; in 1864-5-6 and 7, 200 lbs. Silicate of Soda and 200 lbs. Silicate of Lime were applied ^{per acre} but in 1868 and 1869, 125 lbs. of each were applied. { 12 } Averages of 6 years, 12 years, and 18 years. { 15 } Averages of 11 years, 12 years, and 23 years.

(18) Averages of 20 years (with dung), 4 years (unmanured), and 24 years. These plots ("AAS") comprise, respectively, one half of the original "AA" plots, and no Silicate of Lime. These plots ("AAS") were put across, but in 1908, and since, 400 lbs. Silicate of Soda, and 400 lbs. Superphosphate, respectively, one half of the original "AA" plots, and

EXPERIMENTS ON THE GROWTH OF WHEAT YEAR AFTER YEAR ON THE SAME LAND; WITHOUT MANURE, AND WITH DIFFERENT KINDS OF MANURE.

(Area under experiment, about 13 acres.)

- (11) Made with Murriatic instead of Sulphuric Acid.
- (12) Averages of Mineral Manures, alternated with Ammonia-salts.
- (13) Averages of Ammonia-salts, alternated with Mineral Manures.
- (14) Plots 17 had the Ammonia-salts for the Crop of 1876.
- (15) Plots 18 had the Mineral Manures for the Crop of 1876.
- (16) Averages of 12 years, 11 years, and 23 years only; as, in 1868, owing to a mistake in carting, the produce could not be ascertained.
- (17) The Plots marked "a and b" are divided into duplicate portions, "a" and "b," respectively, which are sown and manured alike; excepting that, for the crops of 1864-65, 1870-71, 1872-73, 1874-75, 1876-77, 1877-78, 1878-79, 1879-80, 1880-81, 1881-82, 1882-83, 1883-84, 1884-85, 1885-86, and 1886-87, the "a" portions of plots 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 7

(1) 300 lbs. per annum for 1858, and previously.
(2) 200 lbs. per annum for Crop of 1858, and previously.
(3) "Superphosphate of Lime"—in all cases, excepting for Plot 19, made from 200 lbs. Bone-ash, 150 lbs. Sulphuric acid sp. gr. 1.7 (and water).
(4) The "Ammonia-salts," in all cases, except parts Sulphate and Murinate of Ammonia of Commerce.
(5) The "Ammonia-salts" in 1852, 275 lbs. in 1853 and 1854, 550 lbs. each year since. No Sulphate of Potash, Soda, or Magnesia, or Superphosphate, in 1852, 1853, or 1854. 99, 475 lbs. Nitrate in 1852, 550 lbs. each year since. 550 lbs. Nitrate is reckoned to contain the same amount of Nitrogen as 400 lbs. "Ammonia-salts."
(6) For 1858, and previously—14 tons of manure instead of Sulphuric Acid.
(7) For 1857 and previously—400 lbs. Sulphate Ammonia, sown in the Autumn.
(8) For 1872 and previously—300 lbs. Sulphate Ammonia and 500 lbs. Rape-cake, sown in the Autumn.
(9) For 1872 and previously, 300 lbs. Sulphate Ammonia and 500 lbs. Rape-cake, sown in the Autumn.
(10) The Measures of Plots 17 and 18 are, year by year transposed.

GEESCROFT FIELD.

EXPERIMENTS ON THE GROWTH OF OATS YEAR AFTER YEAR ON THE SAME LAND; WITHOUT MANURE, AND WITH DIFFERENT KINDS OF MANURE.

Previous Cropping—1847 and 1848, Clover; Experimental Manures; 1849—1859, Beans, Experimental Manures; 1860, Fallow; 1861 and 1862, Wheat, Unmanured; 1863, Fallow; 1864, Beans, Dunged; 1865, Wheat, Unmanured; 1866, Beans, Unmanured; 1867 and 1868, Wheat, Unmanured. First Experimental Oat Crop in 1869.

(Area under Experiment, $\frac{1}{2}$ acre.)

PLOTS.	MANURES, PER ACRE, PER ANNUM.	PRODUCE PER ACRE.												AVERAGE PER ANNUM 5 YEARS, 1869-1873.		
		1ST SEASON, 1869.			2ND SEASON, 1870.			3RD SEASON, 1871.			4TH SEASON, 1872.			5TH SEASON, 1873.		
		Dressed Corn.		Total Straw.	Dressed Corn.		Total Straw.	Dressed Corn.		Total Straw.	Dressed Corn.		Total Straw.	Dressed Corn.		Total Straw.
		Quantity.	Weight per Bushel.	lbs. cwts.	Quantity.	Weight per Bushel.	lbs. cwts.	Quantity.	Weight per Bushel.	lbs. cwts.	Quantity.	Weight per Bushel.	lbs. cwts.	Quantity.	Weight per Bushel.	lbs. cwts.
1	Unmanured	36 $\frac{1}{2}$	36 $\frac{1}{2}$	19 $\frac{1}{2}$	16 $\frac{1}{2}$	35	9 $\frac{1}{2}$	20 $\frac{1}{2}$	33 $\frac{1}{2}$	11 $\frac{1}{2}$	15	36 $\frac{1}{2}$	27 $\frac{1}{2}$	10 $\frac{1}{2}$	33 $\frac{1}{2}$	10 $\frac{1}{2}$
2	{ 200 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3 $\frac{1}{2}$ cwts. Superphosphate of Lime (1) }	45	38 $\frac{1}{2}$	24 $\frac{1}{2}$	19 $\frac{1}{2}$	35 $\frac{1}{2}$	9 $\frac{1}{2}$	22	35 $\frac{1}{2}$	13 $\frac{1}{2}$	10 $\frac{1}{2}$	37 $\frac{1}{2}$	28 $\frac{1}{2}$	24 $\frac{1}{2}$	35	13 $\frac{1}{2}$
3	400 lbs. Ammonia-salts (2)	56 $\frac{1}{2}$	37 $\frac{1}{2}$	36 $\frac{1}{2}$	30	34 $\frac{1}{2}$	17 $\frac{1}{2}$	57 $\frac{1}{2}$	36 $\frac{1}{2}$	40 $\frac{1}{2}$	55 $\frac{1}{2}$	37 $\frac{1}{2}$	32 $\frac{1}{2}$	47	35 $\frac{1}{2}$	28 $\frac{1}{2}$
4	{ 400 lbs. Ammonia-salts, 200 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3 $\frac{1}{2}$ cwts. Superphosphate .. }	75 $\frac{1}{2}$	39 $\frac{1}{2}$	54	50 $\frac{1}{2}$	36	28 $\frac{1}{2}$	58 $\frac{1}{2}$	35 $\frac{1}{2}$	50	62 $\frac{1}{2}$	39 $\frac{1}{2}$	45 $\frac{1}{2}$	59	37	41 $\frac{1}{2}$
5	550 lbs. Nitrate of Soda (3)	62 $\frac{1}{2}$	38 $\frac{1}{2}$	42 $\frac{1}{2}$	36 $\frac{1}{2}$	35 $\frac{1}{2}$	23	55	36 $\frac{1}{2}$	34 $\frac{1}{2}$	42 $\frac{1}{2}$	36 $\frac{1}{2}$	30 $\frac{1}{2}$	47 $\frac{1}{2}$	35 $\frac{1}{2}$	27 $\frac{1}{2}$
6	{ 550 lbs. Nitrate of Soda, 200 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3 $\frac{1}{2}$ cwts. Superphosphate .. }	69 $\frac{1}{2}$	38 $\frac{1}{2}$	49 $\frac{1}{2}$	50	35 $\frac{1}{2}$	28 $\frac{1}{2}$	60 $\frac{1}{2}$	33 $\frac{1}{2}$	48 $\frac{1}{2}$	44 $\frac{1}{2}$	37 $\frac{1}{2}$	63 $\frac{1}{2}$	57 $\frac{1}{2}$	35 $\frac{1}{2}$	35

SECOND 5 YEARS; MINERAL MANURES AS BEFORE, AMMONIA-SALTS AND NITRATE OF SODA ONLY HALF AS MUCH AS PREVIOUSLY.

PLOTS.	MANURES, PER ACRE, PER ANNUM.	PRODUCE PER ACRE.												AVERAGE PER ANNUM 5 YEARS, 1874-1878.		
		6TH SEASON, 1874.			7TH SEASON, 1875.			8TH SEASON, 1876 (4).			9TH SEASON, 1877 (5).			10TH SEASON, 1878.		
		Dressed Corn.		Total Straw.	Dressed Corn.		Total Straw.	Dressed Corn.		Total Straw.	Dressed Corn.		Total Straw.	Dressed Corn.		Total Straw.
		Quantity.	Weight per Bushel.	lbs. cwts.	Quantity.	Weight per Bushel.	lbs. cwts.	Quantity.	Weight per Bushel.	lbs. cwts.	Quantity.	Weight per Bushel.	lbs. cwts.	Quantity.	Weight per Bushel.	lbs. cwts.
1	Unmanured	12	31 $\frac{1}{2}$	7	12 $\frac{1}{2}$	29 $\frac{1}{2}$	5 $\frac{1}{2}$	8 $\frac{1}{2}$	32	2 $\frac{1}{2}$	15 $\frac{1}{2}$	32 $\frac{1}{2}$	5 $\frac{1}{2}$	10 $\frac{1}{2}$	27 $\frac{1}{2}$	5 $\frac{1}{2}$
2	{ 200 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3 $\frac{1}{2}$ cwts. Superphosphate of Lime (1) }	13 $\frac{1}{2}$	31 $\frac{1}{2}$	6 $\frac{1}{2}$	13 $\frac{1}{2}$	29 $\frac{1}{2}$	6 $\frac{1}{2}$	7 $\frac{1}{2}$	30	2 $\frac{1}{2}$	15 $\frac{1}{2}$	32 $\frac{1}{2}$	5 $\frac{1}{2}$	10 $\frac{1}{2}$	27 $\frac{1}{2}$	5 $\frac{1}{2}$
3	200 lbs. Ammonia-salts (2)	37 $\frac{1}{2}$	33 $\frac{1}{2}$	22 $\frac{1}{2}$	30 $\frac{1}{2}$	32 $\frac{1}{2}$	15 $\frac{1}{2}$	17 $\frac{1}{2}$	34 $\frac{1}{2}$	6	15 $\frac{1}{2}$	32 $\frac{1}{2}$	5 $\frac{1}{2}$	10 $\frac{1}{2}$	27 $\frac{1}{2}$	5 $\frac{1}{2}$
4	{ 200 lbs. Ammonia-salts, 200 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3 $\frac{1}{2}$ cwts. Superphosphate .. }	40 $\frac{1}{2}$	34 $\frac{1}{2}$	24 $\frac{1}{2}$	30 $\frac{1}{2}$	34 $\frac{1}{2}$	20 $\frac{1}{2}$	22 $\frac{1}{2}$	35 $\frac{1}{2}$	12 $\frac{1}{2}$	15 $\frac{1}{2}$	32 $\frac{1}{2}$	5 $\frac{1}{2}$	10 $\frac{1}{2}$	27 $\frac{1}{2}$	5 $\frac{1}{2}$
5	275 lbs. Nitrate of Soda (3)	35 $\frac{1}{2}$	30 (4)	16 $\frac{1}{2}$ (4)	23 $\frac{1}{2}$ (4)	31 $\frac{1}{2}$ (4)	11 $\frac{1}{2}$ (4)	12 $\frac{1}{2}$	30 $\frac{1}{2}$	3 $\frac{1}{2}$	15 $\frac{1}{2}$	32 $\frac{1}{2}$	5 $\frac{1}{2}$	10 $\frac{1}{2}$	27 $\frac{1}{2}$	5 $\frac{1}{2}$
6	{ 275 lbs. Nitrate of Soda, 200 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia, and 3 $\frac{1}{2}$ cwts. Superphosphate .. }	28 $\frac{1}{2}$ (4)	33 $\frac{1}{2}$ (4)	16 $\frac{1}{2}$ (4)	28 $\frac{1}{2}$ (4)	33 $\frac{1}{2}$ (4)	14 $\frac{1}{2}$ (4)	19 $\frac{1}{2}$	35 $\frac{1}{2}$	8	15 $\frac{1}{2}$	32 $\frac{1}{2}$	5 $\frac{1}{2}$	10 $\frac{1}{2}$	27 $\frac{1}{2}$	5 $\frac{1}{2}$

(1) "Superphosphate of Lime"—in all cases, made from 200 lbs. Bone-ash, 150 lbs. Sulphuric Acid sp. gr. 1.7 (and water).

(2) "Ammonia-salts"—in each case, equal parts Sulphate and Murate of Ammonia of Commerce.

(3) 550 lbs. Nitrate of Soda is reckoned to contain the same amount of Nitrogen as 400 lbs. "Ammonia-salts."

(4) On these plots, where large quantities of Nitrate of Soda had been applied year after year, the land, though more worked, was so wet that it could not be got into favourable condition for sowing, and the plant was very irregular, up very irregularly, and much of it perished from standing surface-water.

(5) Owing to the very wet winter, 1876-7, the land could not be worked in time for sowing, and is now (1877) left fallow.

EXPERIMENTS ON THE GROWTH OF LEGUMINOUS CROPS.

I.—BEANS, PEAS, AND TARES—GEESCROFT FIELD.

EXPERIMENTS on the growth of Leguminous corn-crops (beans, peas, and tares), with different descriptions of manure, were commenced in 1847, about nine acres being devoted to the purpose.

Experiments with BEANS were continued for thirteen consecutive seasons, to 1859 inclusive; but, during the later years, the crop fell off very much, and the land became very foul.

In 1860 the land was fallowed.

In 1861 a crop of wheat, without manure, was taken.

In 1862 beans were again sown, but with some variation in the manuring.

In 1863 the land was fallowed.

In 1864, 5, 6, 7, 8, and 9, beans were grown, with much the same manures on the same plots, each year, as in 1862.

In the winter of 1869-70, 5000 lbs. of fresh burnt lime were applied per acre, over all the plots.

In 1870 beans were grown with the same manures on the respective plots as in 1864-69.

In October 1870 winter beans were sown (without manure), but the plants were to so great an extent destroyed by the severe weather which followed, that, in April 1871, the crop was ploughed up, and the land left fallow.

During the winter and early spring of 1871-2, the land was so wet that it could not be prepared in time for sowing. It was therefore left fallow for 1872, at the end of May subsoiled to a depth of about 12 inches, and re-ploughed in July. The winter and early spring of 1872-3 were also so extremely wet, that it was again impossible to prepare the land in time for sowing; it was, however, ploughed up towards the end of March, again left fallow, and re-ploughed in July and October (1873). On February 2, 1874, the land was again set with Beans, but without manure. In 1875 Beans were re-sown, with the same manures on the respective plots as in 1864-1870; but owing to the wetness of the land in the first instance, and the subsequent hindrance by other spring sowing, they were not put in until April 1 and 2. The wetness of the winter 1875-6, again prevented the preparation of the land in due time; and, though the manures were sown, and the land ploughed, it was left fallow during the summer of 1876. Winter Beans were put in (drilled), without further manuring, early in October, 1876.

The general result of the experiments with BEANS has been that mineral constituents used as manure (more particularly potass), increased the produce very much during the early

years; and, to a certain extent, afterwards, whenever the season was favourable for the crop. Ammonia-salts, on the other hand, produced very little effect; notwithstanding that a Leguminous crop contains two, three, or more times as much nitrogen as a Gramineous one grown under similar conditions as to soil, &c. Nitrate of soda has, however, produced marked effects. But Leguminous crops grown too frequently on the same land seem to be peculiarly subject to disease, which no conditions of manuring that we have hitherto tried seem to obviate.

Experiments with PEAS were soon abandoned, owing to the difficulty of keeping the land free from weeds, and an alternation of BEANS and WHEAT was substituted; the beans being manured much as in the experiments with the same crop grown continuously as above described. But the wetness of the winter of 1871-72 prevented the sowing of the Beans for the season of 1872; and again the wetness of the autumn and winter of 1872-3 prevented the sowing of the wheat until April 4, 1873, when Nursery wheat was put in, which, however, did not come to maturity, but was cut in the middle of September, yielding about 27 cwt. of gross produce per acre, containing too little corn to be worth thrashing. The land was ploughed in October 1873, and sown with beans February 3, 1874. On October 23, 1874, wheat was sown without manure. Beans should have been sown in 1876; indeed, the manures were sown, but, for the reason stated above, the land was left fallow; and wheat was put in October 24 (1876).

In alternating WHEAT with BEANS, the remarkable result had been obtained, that nearly as much wheat, and nearly as much nitrogen, were yielded in eight crops of wheat in alternation with the highly nitrogenous beans, as in sixteen crops of wheat grown consecutively without manure in another field, and also nearly as much as were obtained in a third field in eight crops alternated with bare fallow.

Experiments with TARES, like those with Peas, were soon abandoned, and for the same reasons. Beans were at first substituted, with some variation in the description of the manures employed; but this experiment has likewise been abandoned for some years. At the present time (1877) the land is devoted to an experiment on the comparative manure-value of decorticated cotton-cake and Indian corn-meal. Cake, at the rate of 1000 lbs. per acre, has been consumed by sheep on one portion, and an equal weight of Indian meal on another portion; the two lots also receiving equal weights of mangolds and straw-chaff; and the land is about to be sown with swedes.

EXPERIMENTS ON THE GROWTH OF LEGUMINOUS CROPS—continued.

II.—RED CLOVER (*Trifolium pratense*)—HOOS FIELD.

EXPERIMENTS on the growth of Clover, with many different descriptions of manure, were commenced in 1849, and, with the occasional interposition of a corn-crop, or fallow, have been continued up to the present time.

As with other *Leguminous* crops, the result was, that mineral constituents applied as manure (particularly potass) considerably increased the early crops; whereas ammonia-salts had little or no beneficial effect, and were sometimes injurious. It may be added that, even up to the present, the beneficial effects of long previous applications of potass are apparent when there is any growth at all. To go a little more into detail:—

In the first year, 1849, the crops were throughout very heavy; especially with mineral, and without nitrogenous manure.

In autumn 1849 wheat was sown, and in spring 1850 Red Clover. In 1851 small cuttings were taken; and in 1852, though the crops were not heavy, there was by no means a failure. Since that time, however, all attempts to grow clover year after year on the same land have failed to give anything like a full crop, or a plant which would stand the usual time on the ground. Small cuttings were obtained in the autumns of 1855 and 1859 from seed sown in the spring of those years, and small but rather heavier cuttings in June and August 1865, from seed sown in 1864.

On two occasions (1851 and 1854) heavy dressings of Farmyard dung were applied to some of the plots; and in 1854 some received a dressing of 20 tons of dung, and 5000 lbs. of lime, per acre.

On some portions of the land Clover was sown 10 times during the 23 years, 1848–1870, and more frequently alone than with a corn-crop; but in 7 out of the last 8 trials the plant died off in the winter and spring succeeding the sowing the seed.

In view of these failures in the field, it is a fact of much interest, that in 1854 Red Clover was sown in a garden, only a few hundred yards distant from the experimental field, on soil which has been under ordinary garden cultivation for probably two or three centuries, and it has every year since shown very luxuriant growth. Seed was re-sown in 1860, 1865, 1868, and 1871. A small cutting was taken in the autumn of 1871, two cuttings in 1872, and two in 1873. Notwithstanding some injury from dodder in 1873, there still remained too much plant to break up; and, accordingly, fresh seed was sown between the rows on May 4, and this failing, again on July 7, 1874. Small cuttings were taken June 11, July 22, and September 30, 1874. A small cutting was again taken on June 22, 1875. On July 13 the old plants were dug in, and seed again sown, and this failing, seed was re-sown September 22. In spring 1876 there was luxuriant growth, but deficient plant; from which two small cuttings were taken, on June 26, and August 7. On September 1, the beds were dug up, and resown with seed, which came up fairly, but the plant suffered during the winter, and now (May 1877) it has been dug up and resown. This, (1877) is, therefore, the 24th season of the growth of Clover, year after year, on this plot of garden ground.

In reference to the field experiments, it may be added that, in 1864, a portion of the land was trenched 2 feet deep, and one-third of the manure was mixed with the layer from 24 to 16 inches, one-third from 16 to 8 inches, and the remainder from 8 inches upwards. Owing to the characters of the season, the mechanical condition of the land was at first very unfavourable after this treatment; but, although many years have now elapsed, and the excess of constituents supplied was in some cases considerable, the plant has died off as completely on these plots as elsewhere.

Again, in the winter of 1867–8 small portions of the experimental land were dug, some to the depth of 9 inches, some to the depth of 18, some to the depth of 27, and some to the depth of 36 inches, and sown to the respective depths with different mixtures; supplying in some cases very large amounts of potass, soda, lime, magnesia, phosphoric acid, sulphuric acid, nitrate of soda, &c. From other similar sized plots, the soil was removed to the depths of 9, 18, and 27 inches respectively, and replaced by soil taken at the same depths from the garden border, on a portion of which clover had been grown successfully since 1854, as above referred to. In April 1868 clover was sown over the whole of these small plots, and on some other portions of the land not so treated; but the plant for the most part died off during the following winter.

In April 1869 the same portions were re-sown, small quantities of clover were cut in September of that year, but the plant again died off in the winter.

In April 1870 Clover was sown over the whole of the experimental land, this time in conjunction with Barley; but on those portions which had also been sown in 1868 and 1869 the plant again died off during the winter and early spring; whilst from those which had not been sown in 1868 and 1869 two small cuttings were taken in 1871. In the spring of 1872, the plant being then almost entirely gone, the land was ploughed up. It was again ploughed in July 1872, and in March 1873; the intention being to sow some other *Leguminous* crop; but owing to the wetness and lateness of the season this was not done; the land was again left fallow, and re-ploughed in the beginning of June and the end of July (1873). On May 4, 1874, the land was again ploughed, and sown with Red Clover seed, May 5, without manure. The plant came up well, and was very forward in September, when the flowering stems were cut down, but left on the land. During the winter and early spring the plant on those portions from which cuttings had been taken in 1871 almost entirely failed, and the land was ploughed up in May, and again in August (1873); whilst on those from which none had been taken since 1869 a fair plant remained, and two small cuttings were obtained, namely on June 23, and on August 9 and 12 (1875). On September 22, this portion of the land was ploughed up. In May (1876) the whole was re-ploughed, again in July and September, and left fallow. At the present time (May 1877) Barley has been sown over the whole, but without further manuring.

In the spring of 1871 the *small* plots in the field were again re-sown, and those of the garden-soil were entirely enclosed, both around and above, by galvanised wire netting. Small

EXPERIMENTS ON THE GROWTH OF LEGUMINOUS CROPS—*continued*.

cuttings were taken from these small beds in July 1872, and (excepting from the garden-soil plots, which had yielded considerably more than the others in 1872) larger cuttings were taken in July 1873. The produce was the largest where potass and nitrate of soda were employed, and where they were applied in the largest quantity, and at the greatest depths. In April 1874 there was still some healthy plant on all the plots, but it was considered to be too irregular to preserve. It was, therefore, dug in. The artificially-manured plots were remanured as before, but only to the depth of 9 inches, and seed was sown on May 4th, July 6th, and October 22nd; each time the plant coming up well, but subsequently dying off. On the Garden soil plots, the plant from the first sowing (May 4), for the most part stood; requiring only to be made good here and there on July 6; and in September small cuttings were taken. In May, 1875, the plant was entirely gone on the artificially-manured plots, which were then dug up, and prepared for resowing. On the garden soil plots, though the rows were imperfect, some healthy plants still remained, and gave a small cutting on June 22. On July 24 these plots were dug up; and they, as well as the artificially manured ones just referred to, were re-sown with seed. All came up well, but in May (1876), the plants on the garden soil plots were entirely gone, and those on the artificially manured ones nearly so, but they yielded small cuttings on July 17. More small plots were arranged in the spring of 1874; on which the manures were dug in, at the various depths, on May 11th to 14th, and the seed sown on May 16th. One series received sulphate of potass only, another nitrate of soda only, and a third the two together. The plants came up fairly well, but there were some blanks in the rows, which were re-sown on October 22 (1874). A cutting was taken on June 22 and 23 (1875); the blanks in the rows were re-sown on July 24; a second cutting taken on August 17; and the blanks again re-sown on September 22 (1875). The plant was the most even on the plots with sulphate of potass, less so on those with nitrate of soda, and less still on those with both together. The amount of produce was also greater with each of the manures used separately, than with the mixture of the two. The plants on these new artificially manured plots, like those on the older ones, showed failure in the spring of 1876; but also, like them, gave small cuttings in July. All the small beds were dug up in August; the artificially manured ones remanured as in 1874, the manures dug in to a depth of 9 inches, and seed was sown on September 1, which came up, but the plants died off on all the plots in the winter of 1876-7. At the present time, May 1877, all the small beds are dug up, and sown with Barley and Clover.

The general result of the experiments in the field has been—that neither organic matter rich in carbon as well as other

constituents, nor ammonia-salts, nor nitrate of soda, nor mineral constituents, nor a complex mixture, supplied as manure, availed to restore the clover-yielding capabilities of the land; though, where some of these were applied in large quantity, and at considerable depths, the result was better than when they were used in only moderate quantities and applied only on the surface.

On the other hand, it is clear that the garden-soil has supplied the conditions under which clover can be grown year after year on the same land for many years in succession.

The results obtained on the garden-soil seem to show that what is called "clover-sickness," cannot be due to the injurious influence of excreted matters upon the immediately succeeding crop.

That Clover frequently fails coincidently with injury from parasitic plants, or insects, cannot be disputed; but it may be doubted whether such injury should be reckoned as the cause, or merely the concomitant and an aggravation, of the failing condition.

The results of the experiments seem, therefore, to exclude the supposition that the primary cause of failure is either destruction by parasitic plants or insects, injury from excreted matters, or the shade of a corn-crop, and to indicate that it must be looked for in exhaustion of the soil. Still there remain several open questions. Is it exhaustion of certain organic matters rich in carbon, of nitrogenous food, or of mineral constituents? Again: is there an absolute deficiency in the soil of some of the substances in question, or only an unfavourable condition of combination, or, so to speak, of *soil-digestion* of them, for the requirements of Leguminous plants? Or, is there only an unfavourable distribution of them within the soil, considered in relation to the extent and character of the root-range of the crop?

These various suggestions cannot be further considered within the limits of this brief notice, which may be concluded by the following quotation from Rothamsted papers on the subject ('Journal of the Royal Agricultural Society of England,' vol. xxi. Part I. p. 178; and 'Journal of the Royal Horticultural Society of London,' vol. iii. p. 86, 1872).

"When land is not what is called 'clover-sick,' the crop of clover may frequently be increased by top-dressings of manure containing potass and superphosphate of lime; but the high price of salts of potass, and the uncertainty of the action of manures upon the crop, render the application of artificial manures for clover a practice of doubtful economy.

"When the land is what is called 'clover-sick,' none of the ordinary manures, whether 'artificial' or natural, can be relied upon to secure a crop.

"So far as our present knowledge goes, the only means of insuring a good crop of Red Clover is to allow some years to elapse before repeating the crop upon the same land."

(9)

EXPERIMENTS ON ROOT-CROPS.—BARN FIELD.

Experiments with Turnips were commenced in 1843. Eight acres, divided into numerous Plots, were set apart for the purpose, and the crop was grown for ten consecutive years on the same land; "Norfolk Whites" 1843-1848, and "Swedes" 1849-1852; on some Plots without manure, and on others with different descriptions of manure. Barley was then grown for three consecutive seasons, 1853-1855, without manure, in order to test the comparative corn-growing condition of the different Plots, and also to equalise their condition, as far as possible, by the exhaustion of some of the most active and immediately available constituents supplied by the previous manuring. A new series of experiments with Swedes was arranged in 1856, having regard to the character of the manures previously applied on the different Plots, and to the results previously obtained. This second series was continued for fifteen years, namely, from 1856 to 1870 inclusive. The results obtained with Norfolk Whites in the first three years, 1843, 1844, and 1845, were published in the 'Journal of the Royal Agricultural Society of England,' vol. viii. Part II., 1847; and an abstract of the results obtained from 1845 to 1870 inclusive, is given in the Table below. During the five years, 1871-1875, the land was devoted to experiments with Sugar-Beet, for particulars of which see pp. 10 and 11. In 1876 experiments with Mangold-wurzel were substituted, and are still in progress (see p. 12).

(Area under experiment, about 8 acres; quantities, average, per acre, per annum.)

NORFOLK WHITE TURNIPS; FOUR SEASONS, 1845-1848; Roots and Leaves carted off the Land.

				Each Plot as Series 1, and Cross-dressed as under—							
				SERIES 2. No Cross-dressing.		SERIES 3. 160 lbs. Sulphate Ammonia. 75 lbs. Muriate Ammonia.		SERIES 4. 160 lbs. Sulphate Ammonia. 75 lbs. Muriate Ammonia. 1840 lbs. Rape-cake.		SERIES 5. 1840 lbs. Rape-cake.	
SERIES 1. Manures as under; no Cross-dressing.											
Average Produce, per Acre, per Annum.											
				Roots.		Leaves.		Roots.		Leaves.	
				Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
PLOTS.	3	Gypsum 1845; without Manure 1846 and since (average 1846, 7, 8)		1 4	0 17	1 7	1 0	5 10	3 19	6 11	3 3
	4	Superphosphate, each year; Potass, Soda, and Magnesia, 1847-8 ..		8 1	2 15	9 15	4 3	10 5	6 1	11 2	4 12
	5	Superphosphate, each year;		8 16	2 19	9 18	4 8	10 1	6 3	10 18	4 15
	6	Superphosphate, each year; and Potass 1847-8		8 0	2 19	9 16	5 4	10 7	6 17	10 17	5 7
	7										

SWEDISH TURNIPS; FOUR SEASONS, 1849-1852; Roots and Leaves carted off the Land (excepting 1849, when the Leaves were too small to weigh or remove).

PLOTS.		Each Plot as Series 1, and Cross-dressed, as under, in 1849 and 1850. No Cross-dressing in 1851 and 1852.									
		SERIES 1. Manures as under; no Cross-dressing.		SERIES 2. No Cross-dressing.		SERIES 3. 200 lbs. Ammonia-salts.		SERIES 4. 200 lbs. Ammonia-salts. 2000 lbs. Rape-cake.		SERIES 5. 2000 lbs. Rape-cake.	
		Roots.		Leaves.		Roots.		Leaves.		Roots.	
		Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
3	Without Manure, 1846 and since	2 6	0 6	3 17	0 6	7 0	0 17	7 14	0 13		
4	Superphosphate, Sulphates Potass and Magnesia, and Soda-ash ..	7 17	0 10	9 9	0 11	13 1	0 18	12 7	0 15		
5	Superphosphate	7 9	0 11	8 14	0 13	11 4	1 1	10 10	0 17		
6	Superphosphate, and Sulphate Potass	6 16	0 9	8 14	0 10	12 8	0 17	11 14	0 14		

BARLEY, without Manure (after Roots manured as above); THREE SEASONS, 1853-1855.

PLOTS.		SERIES 1.		SERIES 2.		SERIES 3.		SERIES 4.		SERIES 5.	
		Dressed Corn.	Straw.	Dressed Corn.	Straw.	Dressed Corn.	Straw.	Dressed Corn.	Straw.	Dressed Corn.	Straw.
		Bushels.	Cwts.	Bushels.	Cwts.	Bushels.	Cwts.	Bushels.	Cwts.	Bushels.	Cwts.
3	.. .. .	18½	12½	20½	12½	24½	15½	25½	16		
4	.. .. .	20½	12½	22½	13	25	14½	25½	14½		
5	.. .. .	21	11½	23	12½	26½	15	27	15½		
6	.. .. .	18½	10½	20½	11½	25	14½	25	14½		

SWEDISH TURNIPS; FIFTEEN SEASONS, 1856-1870. (1) Roots and Leaves carted off the Land.

PLOTS.		Each Plot as Series 1, and Cross-dressed as under—									
		SERIES 1. Manures as under; no Cross-dressing.		SERIES 2. 5 years, 1856-1860. 3000 lbs. Saw-dust. 328 lbs. Nitric Acid.		SERIES 3. 5 years, 1856-1860. 200 lbs. Ammonia-salts. 10 years, 1861-1870. 400 lbs. Ammonia-salts.		SERIES 4. 5 years, 1856-1860. 200 lbs. Ammonia-salts. 3000 lbs. Sawdust. 10 years, 1861-1870. 400 lbs. Ammonia-salts. 2000 lbs. Rape-cake.		SERIES 5. 5 years, 1856-1860. 3000 lbs. Sawdust. 10 years, 1861-1870. 2000 lbs. Rape-cake.	
		Roots.		Leaves.		Roots.		Leaves.		Roots.	
		Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
1	Farmyard Manure, 14 tons	6 4	0 17	7 9	1 2	8 8	1 4	8 16	1 9	8 0	1 4
2	Farmyard Manure, 14 tons, and Superphosphate	6 7	0 16	7 13	1 3	8 5	1 5	8 14	1 9	7 16	1 2
3	Without Manure, 1846, and since	0 11	0 3	0 19	0 4	0 13	0 3	3 6	0 14	3 8	0 13
4	Superphosph., each year; Sulph. Potass, Soda, and Magnesia, 1856-60	2 16	0 8	5 2	0 16	4 12	0 14	6 12	1 6	5 8	0 17
5	Superphosphate, each year	2 12	0 9	4 13	0 18	3 16	0 15	5 16	1 7	5 0	0 19
6	Superphosphate, each year; Sulphate Potass, 1856-1860	2 7	0 7	4 11	0 14	4 5	0 13	6 6	1 2	5 3	0 16
7	Superphosph., each year; Sulph. Potass, and 36½ Amm.-salts, 1856-60	2 12	0 7	4 13	0 14	4 12	0 14	6 15	1 4	5 9	0 17
8	Unman. 1853, and since; previously part Unman.; part Superphosph.	1 3	0 4	1 13	0 5	1 2	0 5	3 19	0 18	3 14	0 19

NOTE.—"Sulphate of Ammonia" is estimated to contain 23 per cent. Ammonia, and "Muriate of Ammonia" 27 per cent. "Ammonia-salts," in each case, equal parts Sulphate and Muriate of Ammonia of commerce; and the mixture is estimated to contain 25 per cent. Ammonia. The 328 lbs. Nitric Acid (Sp. gr. 1.35), mixed with sawdust, and used as a cross-dressing on the Plots of Series 2, from 1856-1860, were estimated to contain Nitrogen = 53 lbs. Ammonia.

(1) The crops of 1859 and 1860 failed, and were ploughed in; but, as the manures were applied, and there would be accumulation within the soil for the succeeding crops, the average produce is calculated as for 15 years, that is the produce of the 15 years is, in each case, divided by 15.

EXPERIMENTS ON SUGAR BEET (VILMORIN'S GREEN-TOP WHITE SILESIA)—BARN FIELD.

GROWN YEAR AFTER YEAR ON THE SAME LAND, WITHOUT MANURE, AND WITH DIFFERENT DESCRIPTIONS OF MANURE, COMMENCING 1871.

Previous Cropping:—1843-'48 (6 Seasons), experiments on Norfolk White Turnips, with different descriptions of Manure.

1849-'52 (4 Seasons), experiments on Swede Turnips, with different descriptions of Manure.

1853-'55 (3 Seasons), Barley without Manure (with a view as far as possible to equalise the condition of the Plots).

1856-'70 (15 Seasons), experiments on Swede Turnips, with different descriptions of Manure, in which the arrangement of the

Plots was the same, and that of the Manures very similar—in fact, exactly the same during the last 10 years—as in the first year of Sugar Beet, excepting that, during those 10 years, the Alkalies were omitted for the Swedes. For the second and subsequent years of Sugar Beet slight alterations in the Mineral Manures were made, and in the fourth and fifth years the Farmyard Manure, Nitrate of Soda, Ammonia-salts, and Rape-cake were omitted, as will be seen below. Seed dibbled on the flat; in rows 22 inches apart, and 11 inches apart in the rows; plants moulded up afterwards. Roots all carted off, Leaves weighed, spread on the respective Plots, and ploughed in.

Area under experiment about 8 acres. The experiments are arranged as under, in 5 Series, each of which comprises 8 Plots.

		Manures, per Acre, per Annum.									
PLOTS.		SERIES 1.		SERIES 2.		SERIES 3.		SERIES 4.		SERIES 5.	
				Each Plot as Series 1, and Cross-dressed with 550 lbs. Nitrate Soda.		Each Plot as Series 1, and Cross-dressed with 400 lbs. "Ammonia-salts."		Each Plot as Series 1, and Cross-dressed with 2000 lbs. Rape-cake, and 400 lbs. "Ammonia-salts."		Each Plot as Series 1, and Cross-dressed with 2000 lbs. Rape-cake.	
FIRST SEASON, 1871.											
		PRODUCE PER ACRE (Roots trimmed as for feeding, not as for Sugar-making).									
		Roots.		Leaves.		Roots.		Leaves.		Roots.	
		Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
1	Farmyard Manure (14 tons)	18 3	3 5	27 13	6 19	22 1	5 6	26 4	6 14	28 18	5 14
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹)	14 13	2 14	25 16	5 15	21 15	4 6	25 2	6 7	25 4	5 5
3	Without Manure (1846, and since)	7 11	2 0	22 3	5 12	15 6	4 16	19 18	7 0	20 16	4 12
4	3½ cwt. Superphosphate, 300 lbs. Sulphate Potass, 200 lbs. Sulphate Soda, 100 lbs. Sulphate Magnesia	7 11	1 5	22 15	4 8	17 10	3 5	22 15	6 3	21 7	3 19
5	3½ cwt. Superphosphate	5 12	1 8	20 19	3 14	15 4	3 19	19 18	7 12	18 19	4 5
6	3½ cwt. Superphos., 300 lbs. Sulph. Potass	5 1	1 4	21 5	3 13	17 4	3 4	23 11	6 11	21 0	3 11
7	3½ cwt. Superphos., 300 lbs. Sulph. Pot., 36½ lbs. Amm.-salts (²) ..	5 18	1 5	20 19	3 18	18 8	4 3	21 0	5 0	21 7	3 17
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	7 10	1 14	21 13	3 16	16 2	4 15	17 19	7 11	20 7	4 9
SECOND SEASON, 1872.											
		Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
1	Farmyard Manure (14 tons)	15 13	4 2	23 9	7 19	22 14	9 0	26 8	9 11	22 5	6 1
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹)	16 0	3 18	24 6	8 16	22 0	7 16	25 9	9 14	26 15	5 11
3	Without Manure (1846, and since)	7 17	1 13	21 7	6 6	15 3	4 13	20 8	10 1	16 3	3 11
4	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride Sodium (common salt), 200 lbs. Sulphate Magnesia	6 14	1 10	20 2	5 19	15 10	3 7	23 8	7 13	17 18	3 15
5	3½ cwt. Superphosphate	6 17	1 8	19 6	6 4	14 5	4 13	18 11	10 4	15 18	3 16
6	3½ cwt. Superphos., 500 lbs. Sulph. Potass	6 6	1 5	16 16	5 14	14 7	3 19	22 16	9 9	15 17	3 14
7	3½ cwt. Superphos., 500 lbs. Sulph. Potass, 36½ lbs. Amm.-salts (²) ..	6 15	1 8	17 0	6 1	15 9	3 19	23 9	9 10	15 10	3 15
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	5 4	1 5	15 6	5 19	13 10	4 1	19 12	9 17	15 0	4 6
THIRD SEASON, 1873.											
		Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
1	Farmyard Manure (14 tons)	15 2	5 12	20 5	10 9	22 2	9 18	22 15	12 10	23 10	7 8
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹)	14 6	5 2	21 10	11 0	19 4	8 9	23 7	13 6	21 18	6 18
3	Without Manure (1846, and since)	5 1	1 11	14 5	6 11	9 3	3 16	15 12	9 11	14 13	4 1
4	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride Sodium (common salt), 200 lbs. Sulphate Magnesia	5 2	1 13	16 9	6 11	12 10	3 10	20 3	8 0	16 1	3 8
5	3½ cwt. Superphosphate	5 5	1 11	18 8	5 13	10 19	5 0	14 15	9 8	13 19	4 9
6	3½ cwt. Superphos., 500 lbs. Sulph. Potass	4 12	1 5	15 17	4 4	12 18	3 12	20 2	9 5	14 14	3 11
7	3½ cwt. Superphos., 500 lbs. Sulph. Potass, 36½ lbs. Amm.-salts (²) ..	5 19	1 12	16 14	5 3	13 0	4 15	19 16	9 0	15 17	4 4
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	4 11	1 7	12 9	5 18	8 8	2 19	15 2	9 8	12 2	3 16
FOURTH SEASON, 1874 (³). Mineral Manures as in 1872 and 1873; but no Farmyard Manure, or cross-dressings of Nitrate Soda, Ammonia-salts, or Rape-cake.											
		Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
1	Without Manure, 1874 and 1875 (Farmyard Manure in '71, '72, '73) ..	10 16	5 6	11 14	8 9	11 7	8 3	13 7	9 17	14 10	7 8
2	3½ cwt. Superphosphate (with Farmyard Manure, '71, '72, '73) ..	13 3	5 9	7 9	4 16	9 5	5 17	12 5	7 7	13 1	6 4
3	Without Manure (1846, and since)	5 2	1 5	3 2	2 6	3 7	2 2	2 11	2 10	3 19	2 9
4	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride Sodium (common salt), 200 lbs. Sulphate Magnesia	6 10	1 8	8 16	3 6	7 10	2 0	10 12	4 16	8 2	3 11
5	3½ cwt. Superphosphate	5 19	1 7	7 10	3 6	7 6	2 8	7 15	5 4	5 17	3 6
6	3½ cwt. Superphos., 500 lbs. Sulph. Potass	5 11	1 5	8 1	2 14	8 1	1 18	9 10	4 13	7 13	3 2
7	3½ cwt. Superphos., 500 lbs. Sulph. Pot., and Amm.-salts, '71, '72, '73 ..	6 14	1 3	9 5	2 11	8 15	1 14	11 14	4 11	8 4	3 9
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	5 0	1 2	7 13	2 16	6 10	2 0	7 6	4 7	3 12	2 1
FIFTH SEASON, 1875. Mineral Manures as in 1872, 1873, and 1874; but no Farmyard Manure, or cross-dressings of Nitrate Soda, Ammonia-salts, or Rape-cake.											
		Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
1	Without Manure, 1874 and 1875 (Farmyard Manure in '71, '72, '73) ..	17 5	2 11	19 18	2 14	21 0	3 6	22 7	3 12	19 13	2 11
2	3½ cwt. Superphosphate (with Farmyard Manure, '71, '72, '73) ..	15 11	2 2	19 18	2 18	18 17	2 18	20 9	3 5	18 10	2 1
3	Without Manure (1846, and since)	5 9	1 1	9 5	1 12	8 0	1 3	14 1	2 13	11 17	1 10
4	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride Sodium (common salt), 200 lbs. Sulphate Magnesia	5 9	1 0	9 8	1 7	7 16	1 1	12 14	1 14	10 3	1 7
5	3½ cwt. Superphosphate	5 11	1 2	9 19	1 10	7 16	1 4	13 17	2 8	11 2	1 14
6	3½ cwt. Superphos., 500 lbs. Sulph. Potass	5 4	1 0	8 4	1 4	7 1	1 2	12 8	2 3	10 2	1 9
7	3½ cwt. Superphos., 500 lbs. Sulph. Pot. and Amm.-salts '71, '72, '73 ..	5 11	1 1	8 2	1 6	7 6	1 1	11 17	1 17	10 6	1 11
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	4 15	1 0	7 4	1 2	6 1	1 4	12 2	2 11	11 12	2 13

(¹) "Superphosphate of Lime"—in all cases made from 200 lbs. Bone-ash, 150 lbs. Sulphuric Acid sp. gr. 1.7 (and water).

(²) "Ammonia-salts"—in each case equal parts Sulphate and Muriate of Ammonia of Commerce.

(³) Owing to the deficiency of Rain for some time after sowing a large proportion of the plants failed. Some were transplanted on plots 1, but not on the other plots; and eventually the plant was (excepting on plots 1) upon the whole very deficient and irregular, the remaining plants being larger than usual.

(11)

EXPERIMENTS ON SUGAR BEET—BARN FIELD—*continued*.

As it will be some time before we shall be able to report fully the results obtained illustrating the influence of different manures, and different seasons, on the composition of Sugar-beet, an abstract of the analytical results obtained is given below. In interpreting the figures it must be borne in mind that with forty different experiments each year, and in each year 4 or 5 or more times as much produce on some plots as on others, it would be impossible to sample each at its best, and all in the same condition of ripeness. Each year the seed was sown on all the Plots at the same time; and the samples (each consisting of the vertical fourths of 10 or 15 roots) were taken from all within a period of about a week, beginning with the ripest. It is obvious, however, that the smaller crops would be much riper than the larger ones. It need only further be observed that although, in comparable cases, the larger crops generally give a juice containing a lower percentage of sugar and higher percentages of mineral matter and of nitrogen, yet, the larger crops yielded very much more sugar over a given area of land.

MEAN PER CENT. SUGAR, MINERAL MATTER (CRUDE ASH), AND NITROGEN, IN JUICE, in Selected cases, each year; 5 years, 1871-5;
and

AVERAGE PRODUCE AND COMPOSITION OF THE ROOTS; FIRST THREE SEASONS, 1871, 1872, and 1873.

FOR MANURES, see page 10.		CROSS-DRESSED MANURES PER ACRE PER ANNUM.														
		SERIES 1. No Cross-dressing.			SERIES 2. As Series 1, and Cross-dressed with 550 lbs. Nitrate Soda.			SERIES 3. As Series 1, and Cross-dressed with 400 lbs. "Ammonia-salts."			SERIES 4. As Series 1, and Cross-dressed with 2000 lbs. Rape-cake, and 400 lbs. "Ammonia-salts."			SERIES 5. As Series 1, and Cross-dressed with 2000 lbs. Rape-cake.		
MEAN PER CENT. SUGAR, MINERAL MATTER (CRUDE ASH), AND NITROGEN, IN JUICE.																
FIRST SEASON, 1871.																
		Sugar.	Ash.	Nitrogen.	Sugar.	Ash.	Nitrogen.	Sugar.	Ash.	Nitrogen.	Sugar.	Ash.	Nitrogen.	Sugar.	Ash.	Nitrogen.
Plot 1	..	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
" 4	..	12.39	0.697	..	10.27	0.897	..	11.63	0.776	..	9.85	0.936	..	10.79	0.776	..
" 5	..	13.68	0.528	..	11.38	0.707	..	12.49	0.668	..	10.42	0.764	..	12.31	0.670	..
" 6	..	13.92	0.553	0.096	11.65	0.640	0.166	12.04	0.662	0.141	9.76	0.730	0.224	12.47	0.582	0.133
	..	13.68	0.597	..	11.02	0.742	..	12.12	0.742	..	10.22	0.772	..	12.71	0.668	..
Means of Plots 4, 5, and 6 ..		13.76	0.559	0.096	11.35	0.696	0.166	12.21	0.691	0.141	10.13	0.755	0.224	12.49	0.640	0.133
SECOND SEASON, 1872.																
Plot 1	..	13.65	0.742	..	12.67	0.877	..	12.58	0.820	..	12.70	0.844	..	13.00	0.818	..
" 4	..	14.90	0.647	0.099	12.83	0.810	0.146	14.02	0.698	0.123	13.33	0.816	0.186	14.08	0.717	0.143
" 5	..	14.65	0.537	0.091	11.75	0.824	0.176	13.71	0.584	0.148	10.95	0.844	0.236	13.92	0.576	0.146
" 6	..	14.54	0.581	..	12.51	0.760	..	14.17	0.728	..	12.79	0.780	..	13.86	0.661	..
Means of Plots 4 and 5 ..		14.78	0.592	0.095	12.29	0.817	0.161	13.87	0.641	0.136	12.14	0.830	0.211	14.00	0.647	0.145
THIRD SEASON, 1873.																
Plot 1	..	13.40	0.756	..	11.79	0.905	..	11.93	0.845	..	10.75	0.948	..	12.25	0.540	..
" 4	..	14.54	0.619	0.132	12.69	0.831	0.174	13.80	0.774	0.158	11.80	0.842	0.176	13.87	0.700	0.147
" 5	..	15.02	0.499	0.110	12.11	0.835	0.179	13.86	0.555	0.183	12.26	0.632	0.212	14.19	0.561	0.169
" 6	..	15.11	0.603	0.114	13.15	0.689	0.156	13.91	0.726	0.156	12.52	0.781	0.198	13.66	0.698	0.148
Means of Plots 4, 5, and 6 ..		14.89	0.574	0.119	12.65	0.785	0.169	13.86	0.685	0.156	12.19	0.752	0.195	13.91	0.653	0.155
FOURTH SEASON, 1874 (1). Mineral Manures as in 1872 and 1873; but no Farmyard Manure, or cross-dressings of Nitrate Soda, Ammonia-salts, or Rape-cake.																
Plot 1	..	11.74	0.972	0.260	10.69	1.144	..	10.30	1.121	..	10.78	1.129	..	11.42	0.935	..
" 4	..	13.79	0.528	0.103	10.24	0.756	0.135	13.06	0.762	0.157	12.23	0.865	0.211	13.21	0.772	0.162
" 5	..	13.69	0.474	0.109	10.29	0.794	0.187	13.07	0.682	0.182	12.16	0.650	0.207	11.39	0.724	0.237
" 6	..	13.67	0.496	0.103	11.05	0.714	0.184	14.41	0.697	0.143	12.68	0.781	0.208	11.62	0.816	0.189
Means of Plots 4, 5, and 6 ..		13.72	0.499	0.105	10.53	0.755	0.169	13.51	0.707	0.161	12.33	0.765	0.209	12.07	0.771	0.199
FIFTH SEASON, 1875. Mineral Manures as in 1872, 1873, and 1874; but no Farmyard Manure, or cross-dressings of Nitrate Soda, Ammonia-salts, or Rape-cake.																
Plot 1	..	12.33	0.626	0.136	12.47	0.637	..	12.12	0.675	..	12.65	0.718	..	12.18	0.668	..
" 4	..	12.75	0.607	0.094	12.69	0.606	0.106	12.97	0.652	0.116	12.52	0.674	0.115	12.30	0.695	0.115
" 5	..	13.67	0.536	0.104	12.73	0.582	0.114	12.72	0.573	0.113	11.79	0.580	0.137	12.43	0.513	0.106
" 6	..	13.33	0.541	0.107	13.13	0.637	..	12.85	0.663	0.110	12.19	0.669	0.150	12.73	0.656	0.118
Means of Plots 4, 5, and 6 ..		13.25	0.561	0.102	12.71	0.594	0.110	12.85	0.629	0.113	12.17	0.641	0.134	12.49	0.621	0.113

AVERAGE PRODUCE AND COMPOSITION, FIRST THREE SEASONS, 1871, 1872, and 1873.

PLOT 1 (SERIES I.), Farnyard Manure (14 Tons).

Average produce per acre :—		Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
Roots	326	476	446	502	498	498
Leaves	86	169	161	192	128	128
Total	412	645	607	694	626	626
Average Composition of the Roots :—		Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Dry Matter	17.49	16.11	16.56	16.23	16.66	16.66
Mineral Matter (ash) in Dry Matter ..	5.00	6.11	5.83	6.55	5.61	5.61
Nitrogen in Dry Matter (?)	0.83	1.24	1.53	1.52	1.24	1.24
Sugar in Juice	13.14	11.58	12.05	11.10	12.01	12.01
Sugar in Roots, if 95, P.C. Juice ..	12.48	11.00	11.45	10.55	11.41	11.41

MEANS OF PLOTS 4, 5, and 6 (SERIES I.), Superphosphate, with or without other Mineral Manures, every year.

Average produce per Acre :—		Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
Roots	118	382	290	413	346	346
Leaves	28	102	76	165	76	76
Total	146	484	366	578	422	422
Average Composition of the Roots ..		Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Dry Matter	18.53	15.93	17.43	15.93	17.66	17.66
Mineral Matter (ash) in Dry Matter ..	4.30	5.73	4.81	5.98	4.50	4.50
Nitrogen in Dry Matter (?)	0.54	1.20	0.87	1.52	0.83	0.83
Sugar in Juice	14.45	12.12	13.35	11.56	13.45	13.45
Sugar in Roots, if 95, P.C. Juice ..	13.73	11.51	12.68	10.98	12.78	12.78

(1) Owing to the deficiency of Rain for some time after sowing a large proportion of the plants failed. Some were transplanted on plots 1, but not on the other plots; and eventually the plant was (excepting on plots 1) upon the whole very deficient and irregular, the remaining plants being larger than usual.

(2) The percentages of Nitrogen in the roots relate to the first year only; but the percentages of Nitrogen determined in the Juice, in selected cases, each year, confirm the indications of the nitrogen in the roots in the first year.

(12)

EXPERIMENTS ON MANGOLD WURZEL.—BARN FIELD (after SUGAR-BEET); commencing 1876.

The arrangement of the Plots is precisely the same as previously for Sugar-beet, excepting that Plot 9, which was unmanured for Sugar-beet, and also previously for Swedes, is now added as a manured Plot. With this exception, the manures are also substantially the same as previously for Sugar-beet; in fact, precisely the same as for the Sugar-beet in 1872 and 1873. Seed, Yellow Globe; dibbled on ridges, rows 26 inches apart; plants 11 inches apart in the rows (?). Area under experiment about 8 acres. Roots all carted off, Leaves weighed, spread on the respective Plots, and ploughed in.

MANURES PER ACRE PER ANNUM.											
PLOTS.	SERIES 1.	SERIES 2. As Series 1, and Cross-dressed with 550 lbs. Nitrate Soda.		SERIES 3. As Series 1, and Cross-dressed with 400 lbs. "Ammonia- salts."		SERIES 4. As Series 1, and Cross-dressed with 2000 lbs. Rape-cake and 400 lbs. "Am- monia-salts."		SERIES 5. As Series 1, and Cross-dressed with 2000 lbs. Rape-cake.			
		FIRST SEASON, 1876.									
		PRODUCE PER ACRE.									
		Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.	Roots.	Leaves.
		Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
1	Farmyard Manure (14 tons)	19 12	4 9	25 2	7 5	29 19	7 12	31 9	10 5	24 9	5 19
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹) ..	19 13	4 6	27 13	7 3	29 8	7 10	30 18	9 16	29 19	6 12
3	Without Manure (1846, and since)	6 10	1 14	20 13	5 12	14 3	4 10	19 19	7 7	17 4	4 15
4	{ 3½ cwt. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride } { Sodium (common salt), 200 lbs. Sulphate Magnesia }	8 8	1 15	25 1	6 0	19 19	4 9	30 8	8 13	25 8	5 10
5	3½ cwt. Superphosphate	7 10	1 14	21 0	5 14	13 10	5 1	17 2	7 14	17 17	5 17
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass	6 16	1 12	21 2	5 8	17 15	4 13	26 8	9 0	20 10	5 4
7	3½ cwt. Superphos., 500 lbs. Sulphate Potass, 36½ lbs. Am.-salts (²)	8 13	2 3	22 11	5 14	19 2	5 11	27 2	9 9	20 12	5 15
8	Unmanured, 1853, and since; previously part Unman., part Superphos.	5 9	1 10	15 16	5 3	11 17	4 16	18 2	7 11	15 12	4 18
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (³)	..	..	..	..	25 14	7 6	..	..	..	..
SECOND SEASON, 1877.											
		Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
1	Farmyard Manure (14 tons)										
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹) ..										
3	Without Manure (1846, and since)										
4	{ 3½ cwt. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride } { Sodium (common salt), 200 lbs. Sulphate Magnesia }										
5	3½ cwt. Superphosphate										
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass										
7	3½ cwt. Superphos., 500 lbs. Sulphate Potass, 36½ lbs. Am.-salts (²)										
8	Unmanured, 1853, and since; previously part Unman., part Superphos.										
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (³)										
THIRD SEASON, 1878.											
		Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
1	Farmyard Manure (14 tons)										
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹) ..										
3	Without Manure (1846, and since)										
4	{ 3½ cwt. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride } { Sodium (common salt), 200 lbs. Sulphate Magnesia }										
5	3½ cwt. Superphosphate										
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass										
7	3½ cwt. Superphos., 500 lbs. Sulphate Potass, 36½ lbs. Am.-salts (²)										
8	Unmanured, 1853, and since; previously part Unman., part Superphos.										
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (³)										
FOURTH SEASON, 1879.											
		Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
1	Farmyard Manure (14 tons)										
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹) ..										
3	Without Manure (1846, and since)										
4	{ 3½ cwt. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride } { Sodium (common salt), 200 lbs. Sulphate Magnesia }										
5	3½ cwt. Superphosphate										
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass										
7	3½ cwt. Superphos., 500 lbs. Sulphate Potass, 36½ lbs. Am.-salts (²)										
8	Unmanured, 1853, and since; previously part Unman., part Superphos.										
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (³)										
FIFTH SEASON, 1880.											
		Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
1	Farmyard Manure (14 tons)										
2	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹) ..										
3	Without Manure (1846, and since)										
4	{ 3½ cwt. Superphosphate, 500 lbs. Sulphate Potass, 200 lbs. Chloride } { Sodium (common salt), 200 lbs. Sulphate Magnesia }										
5	3½ cwt. Superphosphate										
6	3½ cwt. Superphosphate, 500 lbs. Sulphate Potass										
7	3½ cwt. Superphos., 500 lbs. Sulphate Potass, 36½ lbs. Am.-salts (²)										
8	Unmanured, 1853, and since; previously part Unman., part Superphos.										
9	Farmyard Manure (14 tons), 3½ cwt. Superphosphate (³)										

(1) "Superphosphate of Lime"—in all cases made from 200 lbs. Bone-ash, 150 lbs. Sulphuric acid, sp. gr.; 1.7 (and water).

(2) "Ammonia-salts"—in each case equal parts Sulphate and Muriate of Ammonia of Commerce.

(3) Plot 9 sown on the flat instead of on ridges; plants ridged up afterwards; rows 22 inches apart, plants 10 inches apart in the rows.

(13)

EXPERIMENTS ON POTATOES.—HOOS FIELD; commencing 1876.

The Land had been under experiments with Wheat, differently manured, from 1856 to 1874; and was fallowed in 1875. Plots 1, 2, 3, and 4 had been unmanured for the Wheat. Plots 5 and 6 had received the same quantity of Ammonia-salts alone every year for the Wheat, as Plot 5 now receives for potatoes: Plot 6 now receiving the same amount of nitrogen, but as Nitrate of Soda, instead of Ammonia-salts. Plots 7 and 8 received the same amount of complex mineral manure, and Ammonia-salts, for the Wheat, as Plot 7 now receives for potatoes; and Plot 8 now receives the same complex mineral manures, and the same amount of nitrogen, but as Nitrate of Soda instead of Ammonia-salts. Plots 9 and 10 received the same complex mineral manures alone for the Wheat as Plot 10 now receives for potatoes; Plot 9 now receives superphosphate only (?).

PLOTS.	MANURES PER ACRE PER ANNUM.	PRODUCE PER ACRE.				
		Tubers.				Tops.
		Good.	Small.	Diseased.	TOTAL.	
FIRST SEASON, 1876.						
1	Unmanured	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Withered, not weighed, spread on the land, and ploughed in.
2	Farmyard Manure (14 tons)	3 6½	0 5½	0 5½	3 17½	
3	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹)	3 18½	0 4	0 3½	4 5½	
4	Farmyard Manure (14 tons), 3½ cwt. Superphosphate, and 550 lbs. Nitrate of Soda	4 14½	0 6½	0 5½	5 6½	
5	400 lbs. Ammonia-salts (²)	5 9½	0 5½	0 19½	6 14½	
6	550 lbs. Nitrate of Soda	2 5½	0 6½	0 6	2 18	
7	400 lbs. Ammonia-salts, 3½ cwt. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	3 2	0 5½	0 9½	3 17½	
8	550 lbs. Nitrate of Soda, 3½ cwt. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.	6 12½	0 9½	1 0	8 2	
9	3½ cwt. Superphosphate	6 17½	0 10	1 8½	8 15½	
10	3½ cwt. Superphosphate, 300 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, and 100 lbs. Sulphate Magnesia	4 18½	0 8½	0 13½	6 1	
		5 3½	0 6½	0 13½	6 3½	
SECOND SEASON, 1877.						
1	Unmanured	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
2	Farmyard Manure (14 tons)					
3	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹)					
4	Farmyard Manure (14 tons), 3½ cwt. Superphosphate, and 550 lbs. Nitrate of Soda					
5	400 lbs. Ammonia-salts (²)					
6	550 lbs. Nitrate of Soda					
7	400 lbs. Ammonia-salts, 3½ cwt. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.					
8	550 lbs. Nitrate of Soda, 3½ cwt. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.					
9	3½ cwt. Superphosphate					
10	3½ cwt. Superphosphate, 300 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, and 100 lbs. Sulphate Magnesia					
THIRD SEASON, 1878.						
1	Unmanured	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
2	Farmyard Manure (14 tons)					
3	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹)					
4	Farmyard Manure (14 tons), 3½ cwt. Superphosphate, and 550 lbs. Nitrate of Soda					
5	400 lbs. Ammonia-salts (²)					
6	550 lbs. Nitrate of Soda					
7	400 lbs. Ammonia-salts, 3½ cwt. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.					
8	550 lbs. Nitrate of Soda, 3½ cwt. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.					
9	3½ cwt. Superphosphate					
10	3½ cwt. Superphosphate, 300 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, and 100 lbs. Sulphate Magnesia					
FOURTH SEASON, 1879.						
1	Unmanured	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
2	Farmyard Manure (14 tons)					
3	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹)					
4	Farmyard Manure (14 tons), 3½ cwt. Superphosphate, and 550 lbs. Nitrate of Soda					
5	400 lbs. Ammonia-salts (²)					
6	550 lbs. Nitrate of Soda					
7	400 lbs. Ammonia-salts, 3½ cwt. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.					
8	550 lbs. Nitrate of Soda, 3½ cwt. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.					
9	3½ cwt. Superphosphate					
10	3½ cwt. Superphosphate, 300 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, and 100 lbs. Sulphate Magnesia					
FIFTH SEASON, 1880.						
1	Unmanured	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.	Tons. cwt.
2	Farmyard Manure (14 tons)					
3	Farmyard Manure (14 tons), and 3½ cwt. Superphosphate (¹)					
4	Farmyard Manure (14 tons), 3½ cwt. Superphosphate, and 550 lbs. Nitrate of Soda					
5	400 lbs. Ammonia-salts (²)					
6	550 lbs. Nitrate of Soda					
7	400 lbs. Ammonia-salts, 3½ cwt. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.					
8	550 lbs. Nitrate of Soda, 3½ cwt. Superphos., 300 lbs. Sulph. Potass, 100 lbs. Sulph. Soda, 100 lbs. Sulph. Mag.					
9	3½ cwt. Superphosphate					
10	3½ cwt. Superphosphate, 300 lbs. Sulphate Potass, 100 lbs. Sulphate Soda, and 100 lbs. Sulphate Magnesia					

(1) "Superphosphate of Lime"—in all cases made from 200 lbs. Bone-ash, 150 lbs. Sulphuric acid, sp. gr. 1.7 (and water).

(2) "Ammonia-salts"—in each case equal parts Sulphate and Muriate Ammonia of Commerce.

(3) The complex mineral manure having been sown in October, 1874, but the Wheat not put in, and therefore no crop taken in 1875, no mineral manures are sown afresh on Plots 7, 8, 9, and 10, for the first crop of potatoes, 1876.

(14)

AGDELL FIELD.

EXPERIMENTS ON AN ACTUAL COURSE OF ROTATION—TURNIPS, BARLEY, LEGUMINOUS CROP (OR FALLOW), AND WHEAT.

These Experiments were commenced in 1848; so that the present crop (1877) is the 30th experimental one, or the second crop of the Eighth Course. One-third of the land has been continuously unmanured; one-third manured with Superphosphate of Lime alone once every four years, that is for the turnip-crop commencing each course; and one-third manured (also for the turnip-crop only) with a complex manure, as described in the foot-note, No. 2.

In the Second, Third, and Fourth Courses, clover was sown, but failed; and in them, and in the Fifth and Sixth Courses, beans were taken instead, on half of each plot, and the other half left fallow; for the third crop of the Seventh Course clover was again sown (spring 1873), on half of each plot, the other half being left fallow.

From half of each of the three plots the whole turnip-crop (roots and leaves) was removed; and on the other half the roots were eaten on the land by sheep, and the uneaten leaves spread and ploughed in. In the case of all the other crops, the total produce was removed from the land.

The abstract of the results given below relates to the portions of each plot from which the turnip-crops were entirely removed; and on which, in the second, third, fourth, fifth, and sixth courses, beans (not fallow) replaced the clover.

(Area under experiment, about 2½ acres.)

1 lb. (pound avoird.) per acre = (about) 1·12 Kilogramme per Hectare, or 0·57 Zollverein Pfund. per Prussian Morgen. 1 cwt. (hundredweight) per acre = (about) 125·5 Kilogrammes per Hectare, or 0·64 Centner per Pr. Morgen.										
Years.	Description of Crop.	PRODUCE PER ACRE.								
		PLOT 1. Unmanured continuously.			PLOT 2. Superphosphate of Lime, ¹ alone, for the Turnip Crops only.			PLOT 3. Complex Manure, ² for the Turnip Crops only.		
		Corn ³ (or Roots).	Straw (or Leaf).	Total Produce. ⁴	Corn ³ (or Roots).	Straw (or Leaf).	Total Produce. ⁴	Corn ³ (or Roots).	Straw (or Leaf).	Total Produce. ⁴
1ST COURSE, 1848-51.										
1848	Norfolk White Turnips	6½ cwt.	45½ cwt.	111½ cwt.	22½ cwt.	106½ cwt.	332 cwt.	218 cwt.	151½ cwt.	369½ cwt.
1849	Barley	4½ bush.	2983 lbs.	5656 lbs.	29½ bush.	2111 lbs.	3841 lbs.	28½ bush.	2083 lbs.	3794 lbs.
1850	Clover (calc ^d . as hay)	..	..	54 cwt.	..	..	57½ cwt.	..	..	63 cwt.
1851	Wheat	28½ bush.	3431 lbs.	5389 lbs.	28 bush.	3371 lbs.	5233 lbs.	28½ bush.	3552 lbs.	5500 lbs.
2ND COURSE, 1852-55.										
1852	Swedish Turnips	26 cwt.	4½ cwt.	30½ cwt.	22½ cwt.	204 cwt.	243½ cwt.	39½ cwt.	36½ cwt.	433 cwt.
1853	Barley	34½ bush.	2430 lbs.	4465 lbs.	28½ bush.	1873 lbs.	3560 lbs.	38½ bush.	2694 lbs.	4573 lbs.
1854	Beans	5½ bush.	1055 lbs.	1445 lbs.	5½ bush.	1103 lbs.	1534 lbs.	9½ bush.	1353 lbs.	2065 lbs.
1855	Wheat	35½ bush.	3619 lbs.	5839 lbs.	35½ bush.	3525 lbs.	5789 lbs.	37½ bush.	3942 lbs.	6371 lbs.
3RD COURSE, 1856-59.										
1856	Swedish Turnips	32 cwt.	2½ cwt.	34½ cwt.	136 cwt.	7½ cwt.	144½ cwt.	33¾ cwt.	12½ cwt.	346½ cwt.
1857	Barley	48½ bush.	2600 lbs.	5337 lbs.	24½ bush.	1475 lbs.	3076 lbs.	48 bush.	2455 lbs.	5163 lbs.
1858	Beans	6½ bush.	1100 lbs.	1515 lbs.	6½ bush.	1155 lbs.	1605 lbs.	12½ bush.	1520 lbs.	2337 lbs.
1859	Wheat	35½ bush.	4030 lbs.	6262 lbs.	34½ bush.	3930 lbs.	6120 lbs.	39½ bush.	4610 lbs.	7154 lbs.
4TH COURSE, 1860-63.										
1860	Swedish Turnips	1 cwt.	(6½ lbs.)	1 cwt.	2½ cwt.	1½ cwt.	30½ cwt.	57½ cwt.	3½ cwt.	90½ cwt.
1861	Barley	38½ bush.	2522 lbs.	4718 lbs.	30½ bush.	2000 lbs.	3775 lbs.	60½ bush.	3940 lbs.	7391 lbs.
1862	Beans	29 bush.	1840 lbs.	3661 lbs.	29½ bush.	2150 lbs.	4040 lbs.	43½ bush.	3280 lbs.	5990 lbs.
1863	Wheat	44½ bush.	3467 lbs.	6350 lbs.	34½ bush.	3390 lbs.	5619 lbs.	44½ bush.	4697 lbs.	7626 lbs.
5TH COURSE, 1864-67.										
1864	Swedish Turnips	8½ cwt.	0½ cwt.	9½ cwt.	63 cwt.	4½ cwt.	72½ cwt.	176½ cwt.	8½ cwt.	183 cwt.
1865	Barley	29 bush.	2154 lbs.	4182 lbs.	33½ bush.	1615 lbs.	3394 lbs.	47½ bush.	2595 lbs.	5143 lbs.
1866	Beans	10½ bush.	1013 lbs.	1699 lbs.	7½ bush.	978 lbs.	1463 lbs.	20½ bush.	1990 lbs.	3343 lbs.
1867	Wheat	21 bush.	2143 lbs.	3473 lbs.	19½ bush.	1966 lbs.	3222 lbs.	23½ bush.	3003 lbs.	4567 lbs.
6TH COURSE, 1868-71.										
1868	Swedish Turnips	Failed, and ploughed up.			Failed, and ploughed up.			Failed, and ploughed up.		
1869	Barley	24½ bush.	1948 lbs.	3358 lbs.	28½ bush.	2035 lbs.	3686 lbs.	42½ bush.	3309 lbs.	5800 lbs.
1870	Beans	13½ bush.	738 lbs.	1391 lbs.	15½ bush.	768 lbs.	1773 lbs.	24½ bush.	1056 lbs.	2664 lbs.
1871	Wheat	20½ bush.	2799 lbs.	4092 lbs.	24½ bush.	3049 lbs.	4521 lbs.	23 bush.	3440 lbs.	4883 lbs.
7TH COURSE, 1872-75.										
1872	Swedish Turnips	34½ cwt.	8½ cwt.	42½ cwt.	170½ cwt.	17½ cwt.	188 cwt.	339½ cwt.	35½ cwt.	375½ cwt.
1873	Barley	23½ bush.	1343 lbs.	2717 lbs.	20½ bush.	1565 lbs.	2875 lbs.	31½ bush.	1723 lbs.	3673 lbs.
1874	Clover	..	..	31½ cwt.	..	..	82½ cwt.	..	..	84½ cwt.
1875	Wheat	21½ bush.	2430 lbs.	3784 lbs.	28½ bush.	3536 lbs.	5328 lbs.	31½ bush.	4635 lbs.	6699 lbs.
8TH COURSE, 1876-79.										
1876	Swedish Turnips	17½ cwt.	5 cwt.	22½ cwt.	182½ cwt.	28½ cwt.	216½ cwt.	356 cwt.	55½ cwt.	411½ cwt.
1877	Barley	..	..	..	..	..	..	..	..	..
1878	Beans	..	..	..	..	..	..	..	..	..
1879	Wheat	..	..	..	..	..	..	..	..	..
SUMMARY—AVERAGE OF THE FIRST 7 COURSES, 1848-1875.										
1848, '52, '56, '60, '64, '72	Swedish Turnips	27½ cwt.	10½ cwt.	38½ cwt.	142½ cwt.	26½ cwt.	168½ cwt.	258½ cwt.	41½ cwt.	300 cwt.
1849, '53, '57, '61, '65, '69, '73	Barley	36½ bush.	2283 lbs.	4343 lbs.	28½ bush.	1809 lbs.	3438 lbs.	42½ bush.	2671 lbs.	5107 lbs.
1850, '54, '58, '62, '66, '70, '74	Clover, 1850 and '74 (calc ^d . as hay)	..	..	42½ cwt.	..	..	55 cwt.	..	..	73½ cwt.
1851, '55, '59, '63, '67, '71, '75	Beans	12½ bush.	1149 lbs.	1980 lbs.	13 bush.	1231 lbs.	2084 lbs.	22½ bush.	1840 lbs.	3224 lbs.
	Wheat	30 bush.	3131 lbs.	5030 lbs.	29½ bush.	3252 lbs.	5122 lbs.	33 bush.	3990 lbs.	6114 lbs.

(1) First Course—100 lbs. Bone-ash, and 100 lbs. Sulphuric Acid (sp. gr. 1.7); Second Course—160 lbs. Bone-ash, 120 lbs. Sulphuric Acid; Third, Fourth, Fifth, Sixth, and Seventh Courses—200 lbs. Bone-ash, and 150 lbs. Sulphuric Acid, *per acre*.

(2) First Course—100 lbs. Pearl-ash, 100 lbs. Bone-ash, 100 lbs. Sulphuric Acid, 100 lbs. Sulphate of Ammonia, 100 lbs. Muriate of Ammonia, and 1000 lbs. Rape-Cake; Second Course—300 lbs. Sulphate of Potass, 100 lbs. Sulphate of Soda, 100 lbs. Sulphate of Magnesia, 160 lbs. Bone-ash, 120 lbs. Sulphuric Acid, 100 lbs. Sulphate of Ammonia, 100 lbs. Muriate of Ammonia, and 2000 lbs. Rape-cake, *per acre*.

(3) The quantities given in *brackets* represent the *Dressed Corn* only.

(4) The "Total Produce" of the Corn-crops includes Dressed Corn, Offal Corn, and Total Straw.

(15)

EXPERIMENTS WITH DIFFERENT DESCRIPTIONS OF WHEAT, IN 1877; AND SUMMARY OF RESULTS OBTAINED IN PREVIOUS YEARS.

Season 1877.													
DRESSED CORN PER ACRE.													
WEIGHT PER BUSHEL.													
1871; Sawpit Field; 3 cwt. Nitrate Soda; after Mangolds with Dung 1876, Carted off.	1872; Foster's Field; 2 cwt. Super- phosphate; 2 cwt. Nitrate Soda; after Roots, carted off.	1873; Long Hoos Field; 1½ cwt. Nitrate; after Mangolds (with Dung), carted off.	1874; Upper Harpenden Field; 2 cwt. Nitrate after Mangolds (with Dung), carted off.	1875; Little Knott Wood Field; 1½ cwt. Nitrate Soda; after Mangolds (with Dung), 1874, carted off.	1876; Harpenden Field; 2 cwt. Nitrate Soda; after Mangolds (with Dung), 1875, carted off.	Average.	1871; Sawpit Field; 3 cwt. Guano; after Mangolds, carted off.	1872; Foster's Field; 2 cwt. Super- phosphate; 2 cwt. Nitrate Soda; after Roots, carted off.	1873; Long Hoos Field; 1½ cwt. Nitrate; after Mangolds (with Dung), carted off.	1874; Upper Harpenden Field; 2 cwt. Nitrate after Mangolds (with Dung), carted off.	1875; Little Knott Wood Field; 1½ cwt. Nitrate Soda; after Mangolds (with Dung), 1874, carted off.	1876; Harpenden Field; 2 cwt. Nitrate Soda; after Mangolds (with Dung), 1875, carted off.	Average.
Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
.. ..	.. ..	40½	56½	40½	49½	46½	.. ..	58½	61½	58½	61	63	61
.. ..	.. ..	48½	67	48½	42½	51½	.. ..	57½	58½	58½	58½	59½	58½
28½	40	35½	50½	38½	40½	38½	60½	61½	61½	61½	59½	62½	60½
32½	37	35½	48½	34½	43½	38½	61½	62½	60½	61½	60½	63½	61½
35½	40½	38½	51½	38½	39½	40½	60	59½	59½	61½	59½	62½	60½
31½	43½	37½	55½	33½	44½	40½	59	60½	60	62½	60½	63	61
31½	41½	35½	47½	38½	38½	38½	62	63	61½	63½	61½	64½	62½
29½	44½	39½	53½	31½	42½	40½	60½	61½	60½	61½	60½	62½	61½
34½	45½	27½	41½	39	37½	37½	63	65	62	65½	62½	66	63½
30½	43½	34½	53½	34½	42½	39½	60½	61½	60½	63	60½	63½	61½
31½	42½	37	51½	36½	46½	40½	61½	62½	61½	62½	57½	63½	61½
.. ..	46½	42	49½	33½	44	43½	.. ..	61½	59½	63	59½	63½	61½
38½	49½	44½	51½	38½	48½	45½	61½	63	59½	63	61½	64½	62½
33½	45½	38½	44½	33½	41½	39½	61	63½	59½	62½	61½	63½	61½
26½	39½	36½	45½	26½	43½	36½	59½	61½	57½	61½	60½	63½	60½
30	35½	36½	43½	26	40½	35½	58½	60	56½	60½	58½	62½	59½
26½	38½	31½	42	32½	37½	34½	62½	63	59½	62½	61½	64½	62½
37	.. ..	46½	53½	37½	40	42½	60½	.. ..	56½	59½	59½	63½	59½
29½	42½	37½	52½	39	45½	41	60½	61½	58½	60½	60	63½	60½
33	39½	38½	52½	38½	38½	40	61½	62½	59½	62½	61½	65½	62½
38½	42½	45½	48½	43½	41½	42½	61½	62½	57½	62	60½	63½	61½
36	45½	47½	59½	46½	47½	47½	60½	61½	58½	61½	61½	63½	61½
.. ..	.. ..	.. ..	.. ..	35	.. ..	35	.. ..	.. ..	.. ..	.. ..	62½	.. ..	62½
.. ..	.. ..	.. ..	.. ..	28	.. ..	28	.. ..	.. ..	.. ..	.. ..	55½	.. ..	55½
.. ..	.. ..	.. ..	.. ..	36½	42½	40½	60½	62½	59½	61½	60½	63½	61½
Mean	42½	38½	50½	36½	42½	40½	60½	62½	59½	61½	60½	63½	61½

(16)

ROTHAMSTED

MAY

SUMMARY STATEMENT OF THE PRESENT AND PREVIOUS

(14 Years, 1864-1877,

Name of Field.	Acres.	PREVIOUS CROPPING							
		1864.	1865.	1866.	1867.	1868.	1869.	1870.	1871.
Thirty Acres	30	Oats, 2 cwt. Guano, 1 cwt. Corn Manure.	Oats, 1 cwt. Guano, 3 cwt. Corn Manure.	Tares and Swedes, Dung and Artificial.	Oats, after Sheep-Folding.	Clover.	Wheat, 2 cwt. Guano.	Oats, 2 cwt. Guano.	Barley, 2 cwt. superphos., 2 cwt. Nitrate Soda.
Upper Harpenden	14	Wheat, 1½ cwt. Guano, 1½ cwt. Corn Manure.	Oats, 1 cwt. Guano, 2 cwt. Corn Manure.	Oats, 2 cwt. Guano, 1 cwt. Sulph. Ammonia.	Tares, Dung, Swedes, Artificial.	Wheat, 2½ cwt. Guano, 1½ th. Sheep-folded.	Oats, 2 cwt. Guano, 1 cwt. dried Blood, ½ cwt. Sulph. Ammonia.	Swedes, Dung and superphosphate.	Wheat, 2 cwt. Guano.
Harpenden	22	Mangolds and Turnips, Dung and Artificial.	Wheat, Sheep-Folded.	Red Clover (peren.), Unmanured.	Wheat, 2½ cwt. Guano.	Oats, 2 cwt. Guano, & 1 cwt. Nitr. Soda. and Sheep-folded.	Swedes, Dung and various Artificial Manures.	Wheat, 3 cwt. Guano.	Oats, 3 cwt. Guano, 1 cwt. Nitrate Soda. Tares, Dung.
Little Hoos	9	Red Clover.	Wheat, 1½ cwt. Guano, 1 cwt. Nitrate Soda, 1 cwt. Corn Manure.	Mangolds, Dung and Artificial.	Wheat, Unmanured.	Oats, 2 cwt. Guano, 1 cwt. Nitrate of Soda.	Barley, 1 cwt. dried Blood, ½ cwt. Sulph. Ammonia, 1 cwt. superphosphate.	Barley, 2½ cwt. Guano.	Barley, 3 cwt. superphos., 2½ cwt. Nitrate Soda.
Fosters' ..	18	Swedes, Dung and Artificial.	Oats, 1 cwt. Guano, 1 cwt. Corn Manure.	Red Clover, Unmanured.	Wheat, 2 cwt. Guano, ½ cwt. Corn Manure.	Oats, 2 cwt. Guano, 1 cwt. Nitrate of Soda.	Barley, 1 cwt. dried Blood, ½ cwt. Sulph. Ammonia, 1 cwt. superphosphate.	Oats, 2 cwt. Guano, 3 cwt. Blood Manure.	Roots, Tares, and Rape, Dung and Artificial.
Knott Wood	30	Red Clover (peren.).	Wheat, Sheep-Folded, 1 cwt. Guano.	Oats, 2 cwt. Guano, 1 cwt. Sulph. Ammonia.	Oats, 2 cwt. Guano, 1 cwt. Sulph. Ammonia.	Swedes, 2 cwt. Guano, 2½ cwt. superphosphate and Dung.	Wheat, 3 cwt. Guano (one-half), Unmanured (one-half), after Swedes ploughed up and Followed.	Oats, 3 cwt. Guano.	Oats, 3 cwt. Guano, 1 cwt. Nitrate Soda.
Little Knott Wood ..	14	Wheat, Unmanured.	Red Clover (peren.), Unmanured.	Red Clover (peren.), Sheep-Folded.	Wheat, 1 cwt. Guano, ½ cwt. Corn Manure.	Oats, 2 cwt. Guano, 1 cwt. Nitrate Soda.	Mangolds, 12 tons Dung, 3 cwt. Guano.	Wheat, 3 cwt. Guano.	Oats, 3 cwt. Guano, 1 cwt. Nitrate Soda.
Sawpit ..	14	Barley, 1½ cwt. Guano, 1 cwt. superphos., 1 cwt. Corn Manure.	Mangolds and Turnips, Dung and Artificial.	Wheat, Unmanured.	Red Clover, Unmanured.	Wheat, 1 cwt. Guano, 1 cwt. Wheat Manure.	Wheat, 3 cwt. Guano.	Mangolds, Dung and 3 cwt. Guano.	Wheat, 3 cwt. Guano.
Rick-yard	8	Wheat, Sheep-Folded, and 3 cwt. Guano.	Barley, 2 cwt. Guano, 1½ cwt. Corn Manure.	Red Clover, Sheep-Folded.	Wheat, Guano.	Barley, 2 cwt. Wheat Manure.	Tares, Dung.	Barley, 1 cwt. Guano.	Mangolds, Dung and 4 cwt. Cotton Cake.
Six Acres ..	6	Wheat, Unmanured.	Red Clover, Unmanured.	Wheat, 2 cwt. Guano, 2 cwt. Corn Manure.	Oats, 3 cwt. Guano.	Beans, Dung.	Wheat, 2 cwt. Guano, 1 cwt. Nitrate of Soda.	Barley, 2½ cwt. Guano.	Barley, 3 cwt. superphos., 2½ cwt. Nitrate Soda.
Clay-Croft	12	Wheat, 2 cwt. Guano, 2 cwt. Corn Manure.	Oats, 2 cwt. Guano, 2 cwt. Corn Manure.	Oats, 2 cwt. Guano, 1 cwt. Sulph. Ammonia.	Beans, Dung.	Wheat, 2 cwt. Guano.	Oats, 2 cwt. Guano, 1 cwt. dried Blood, ½ cwt. Sulph. Ammonia.	Turnips, Dung and 3 cwt. super- phosphate.	Wheat, Unmanured.
Ten Acres ..	10	Oats, 2 cwt. Guano, 1 cwt. Dried Blood.	Tares, Dung.	Turnips, Artificial.	Wheat, Guano.	Red Clover.	Wheat, 2 cwt. Guano.	Oats, 3 cwt. Guano.	Mangolds, Dung and 4 cwt. Cotton Cake.
Agdell ..	9	Barley, 1½ cwt. Guano, 1 cwt. superphos., 1 cwt. Corn Manure.	Red Clover, Unmanured.	Wheat, 1½ cwt. Guano, 1½ cwt. Corn Manure.	Oats, 2 cwt. Guano.	Tares, Dung.	Barley, Unmanured.	Barley, 1½ cwt. Guano, 1½ cwt. super- phosphate.	Mangolds, Dung and 4 cwt. Cotton Cake.
Long Hoos	25	Swedes, Dung and Artificial.	Barley, 1 cwt. Guano, 1 cwt. Corn Manure.	Barley, 1½ cwt. Guano, 1 cwt. Corn Manure.	Mangolds and Swedes, 15 tons Dung, 3 cwt. Guano.	Wheat, 1 cwt. Guano.	Oats, 2 cwt. Guano, 1 cwt. dried Blood, ½ cwt. Sulph. Ammonia.	Sainfoin, Unmanured.	Sainfoin, Unmanured, (Steam cultivated, July.)
Sawyers' ..	25	Barley, 1 cwt. Guano, 1 cwt. Corn Manure.	Swedes, Dung and Artificial.	Wheat and Barley, Sheep-Folded.	Red Clover, Unmanured.	Wheat, 3 cwt. Guano.	Fallow.	Wheat, 4 cwt. Guano.	Wheat, 4 cwt. Guano, 1 cwt. Nitrate Soda.
West Barn	32	Oats, 1½ cwt. Guano, 1½ cwt. Corn Manure.	Red Clover (peren.), Sheep-Folded.	Wheat, 1½ cwt. Guano, 1½ cwt. Corn Manure.	Barley, 1 cwt. Blood Manure, 1 cwt. superphosphate, 1 cwt. Sulph. Ammonia.	Fallow.	Wheat, 3 cwt. Guano.	Sainfoin, Unmanured.	Sainfoin, Unmanured.

(17)

FARM.

1877.

CROPPING, &c., OF THE ARABLE LAND NOT UNDER EXPERIMENT.

inclusive.)

AND MANURING.

1872.	1873.	1874.	1875.	1876.	Crops, &c., Present Season, 1876-77.	Acres.	Name of Field.
Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda, (2½ acres experiment).	Barley (¾ with Grass-seeds). 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Grass (¾), Folded, and 1 cwt. Nitrate. Barley (¾), 2 cwt. superphosphate, 2½ cwt. Nitrate Soda.	Grass (¾), Sheep-folded. Tares (¾) Dung.	Grass (¾), Compost. Wheat (¾), 1 cwt. Nitrate Soda.	Grass (¾), Cattle Grazed. Barley (¾), 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	30	Thirty Acres
Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Mangolds, Dung. (Carted off.)	Wheat (10 acres Varieties). 2 cwt. Nitrate Soda.	Barley, (¾) 3 cwt. Guano, (¾) 2 cwt. superphosphate, 2½ cwt. Nitrate Soda.	Barley (with grass seeds), 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Grass.	14	Upper Harpenden.
Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda. Tares, Dung.	Barley, After Oats—2 cwt. superphosphate; 2 cwt. Nitrate. After Tares—1 cwt. superphosphate; 1 cwt. Nitrate.	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Mangolds, Dung, and 2 cwt. Guano. (Carted off.)	Wheat (Varieties), 2 cwt. Nitrate Soda.	Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	22	Harpenden.
Barley (with Clover). 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Barley (¾), Unmanured. Clover (¾), Unmanured.	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda (1 acre Unmanured).	Barley, where Barley 1873, 2 cwt. superphosphate, 2 cwt. Nitrate of Soda. where Clover 1873, Half quantities.	Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda (¾ with Clover).	Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda (¾ with Clover).	9	Little Hoos.
Wheat, ½ Varieties of Wheat, 2 cwt. superphosphate, 2 cwt. Nitrate Soda, ¾ Sheep-folded.	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda (2 acres experiment).	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Barley, (1) 3½ cwt. Guano, (1) 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda, (1) 1½ cwt. Guano, 1½ Nitrate.	Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Swedes, Dung. Superphosphate, ½ cwt. Nitrate Soda.	18	Fosters'.
Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Tares (¾), Dung. Swedes (¾), Dung, 2 cwt. superphosph.; 2 cwt. Nitrate Soda.	Barley, After Roots and Tares carted, 2 cwt. superphosphate, 2 cwt. Nitrate Soda, After Tares fed, 1 cwt. each.	Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Oats, 2½ cwt. superphosphate, 3 cwt. Nitrate Soda.	Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	30	Knott Wood.
Oats, ¾ Sheep-folded. All, 2½ cwt. superphosph., 2½ cwt. Nitrate Soda.	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Mangolds, Dung. (Carted off.)	Wheat (Varieties), 1½ cwt. Nitrate Soda.	Oats, 2½ cwt. superphosphate, 3 cwt. Nitrate Soda.	Oats (with Clover), 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	14	Little Knott Wood.
Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Oats, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Mangolds, 25 tons Dung. (Carted off.)	Wheat (Varieties), 1½ cwt. Nitrate Soda.	14	Sawpit.
Wheat, Unmanured.	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Tares, Dung. ½ followed by Turnips, 1 cwt. superphosphate, 1 cwt. Nitrate Soda.	Barley, 1 cwt. Nitrate Soda.	Swedes, Dung, and Superphosphate.	Barley, 1 cwt. Nitrate Soda.	8	Rick-yard.
Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Barley, 2 cwt. superphosphate, 2½ cwt. Nitrate Soda.	Barley, 2 cwt. superphosphate, 2½ cwt. Nitrate Soda.	Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Barley (with Clover), 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	6	Six Acres.
Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Clover, Unmanured.	Wheat, 2 cwt. Nitrate Soda.	Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Fallow.	12	Clay-Croft.
Wheat, Unmanured.	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda (5 acres experiment).	Oats, 2 cwt. superphosphate, 2½ cwt. Nitrate Soda.	Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Fallow.	Wheat (with Clover), 2 cwt. Nitrate Soda.	10	Ten Acres.
Wheat, Unmanured (and part Roots).	Clover, Unmanured. Barley, Experiment.	Wheat, 1 cwt. Nitrate Soda (3 acres Experiment, ¾ Clover, ¾ Fallow).	Barley, 2 cwt. superphosphate, 2 cwt. Nitrate Soda. Wheat, 3 acres, Experiment.	Barley, 2½ cwt. superphosphate, 3 cwt. Nitrate Soda. Swedes, 3 acres, Experiment.	Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda. Barley, 3 acres experiment.	9	Agdell.
Mangolds, Dung. (Carted off.)	Wheat, (½ Varieties of Wheat), 1½ cwt. Nitrate Soda.	Oats, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Oats, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Oats (¾), 2½ cwt. superphosphate, 3 cwt. Nitrate Soda. Tares (¾), Dung.	Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	25	Long Hoos.
Barley, 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda.	Oats, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Mangolds and Swedes, Dung.	Barley after Swedes (¾) 2 cwt. superphosphate, 2 cwt. Nitrate Soda. Wheat after Mangolds (¾) 1½ cwt. Nitrate Soda.	Barley (with Clover), 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Barley (¾), 2½ cwt. superphosphate, 2½ cwt. Nitrate Soda. Tares (¾), Dung.	25	Sawyers'.
Sainfoin, Unmanured.	Oats, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Wheat (Oats fed off 1873), 1½ cwt. Nitrate Soda.	Oats, 2 cwt. superphosphate, 2 cwt. Nitrate Soda.	Oats, 2 cwt. superphosphate, (¾) 1½ Nitrate Soda, (¾) 2½ Nitrate Soda.	Fallow.	32	West Barn.