Silviculture Type II Analysis:

Economic Analysis of

Fertilization, Spacing and Planting Regimes in The 100 Mile TSA[1]

November 14, 2008

Introduction

This report summarizes the results of an economic analysis of managed and natural stand silviculture regimes. The existing and future managed stand analysis projects log quality distribution, volume and economic gains associated with between 1 and 3 fertilizer treatments applied to various to stands associated with 4 different analysis units in the 100 Mile House Timber Supply Area.

The existing natural stand analysis summarizes the economic return from fertilization and spacing of existing natural stands. Fertilization treatments were limited to fir and spruce analysis units while spacing treatments were conducted on dry-belt fir sites.

The analysis also summarizes the economic returns from planting pine on unsalvaged dead mountain pine beetle attacked stands.

Definitions

Existing and Future Managed

Table 1 lists the analysis units modeled in the managed stand fertilization analysis. Also listed is the potential area to be treated over the next 5 years.

Table 1. Managed stand analysis units eligible for fertilization.

Analysis Unit #	AU Description	ITG	Site Index	Potential Treatment Area
102	Douglas-fir, poor	1-8,33,34	>7.6 <=13.5	166.1
103	Douglas-fir, good/medium	1-8,33,34	>13.5	1,898.3
106	Spruce-balsam	18-26	>7.6 <=13	2388.5
107	Spruce-balsam	18-26	> 13	4,802.1

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The following method is used for creating labels in the accompanying graphs and table to represent various combinations of current or future stand conditions, analysis unit and treatment regimen. The following is an example: C102-40-50. In this example the "C" represents current or existing stand conditions (for those stands less than 40 years old), 102 represents the analysis unit to which a fertilization regime is applied, and 40 and 50 the year in which a first and a second treatment are applied respectively. The label itself denotes a fertilization regimen. An "F" may be used instead of a "C" to represent future stand conditions. One, two or three fertilizer treatments may be applied within a given regimen.

Existing Natural

Table 2 lists the analysis units and silviculture regimes applied to existing natural stands. Also listed is the potential area to be treated over the next 5 years.

Table 2. Regimes applied to existing natural stand analysis units.

Analysis Unit #	AU Description	ITG	Site Index	Regimes	Potential Treatment Area
2	Douglas-fir, poor	1-8,33,34	>7.6 <=13.5	Late rotation fertilization	518.5
3	Douglas-fir, good/medium	1-8,33,34	>13.5	Late rotation fertilization	10,615.5
6	Spruce-balsam	18-26	>7.6 <=13	Late rotation fertilization	4,136.2
7	Spruce-balsam	18-26	> 13	Late rotation fertilization	21,787
10	Dry-belt fir, selection (IDF and SBPS)	1-8	>7.6	Spacing	21,318.7
11	MDWR habitat, selection, >=40% fir, low crown closure class (<4)	1-34	>7.6 <=12	Spacing	1,563.8
12	MDWR habitat, selection, >=40% fir, low crown closure class (<4)	1-34	>12	Spacing	1,639.6
13	MDWR habitat, selection, >=40% fir, mod to high crown closure class (>=4)	1-34	>7.6 <=12	Spacing	356.6
14	MDWR habitat, selection, >=40% fir, mod to high crown closure class (>=4)	1-34	>12	Spacing	2,376.6

The regime and stand age is represented in the accompanying results table.

Unsalvaged Planted Pine

The revised base case assumed that unsalvaged pine analysis units regenerated back to natural stand conditions according to natural regeneration potential. Pine analysis units (ITG 28-32) were defined as analysis unit 8 (poor site, SI >7.6 <=12.5) and analysis unit 9 (good/medium, SI >12.5).

Stands with high regeneration potential had no regeneration delay and no yield curve reduction. Stands with moderate regeneration potential had a 15 year regeneration delay and a 25% yield curve reduction. Stands with low regeneration potential had a 25 year regeneration delay and a 75% yield curve reduction.

Methods

Existing and Future Managed

Growth and Yield

Initial growth and yield statistics were developed for each analysis unit by species, by year for individual analysis units within the 100 Mile House TSA using TIPSY v. 4.1. Data included: number of stems per hectare, basal area, merchantable volume (> 12.5 cm dbh and > 17.5 cm dbh) and recovered log volume by log grade (H, I, J, U, X, Y). These statistics were developed for current or existing stands less than 40 years old, and for future stands that have yet to be established following harvesting.

Analysis units 102, 103, 106 and 107 were considered eligible for fertilization, with up to 3 early treatments. The earliest treatment was identified as being applied when a stand reached approximately 5 metres in height. Maximum response was assumed to have occurred at the end of a 10 year period, after which it was assumed that the stand would be advanced 5 years along the curve beyond what it might otherwise have, had it not been fertilized. The impacts of applying a second treatment were then evaluated, either at that time (10 years after the initial treatment) or 10 years later (20 years after the initial treatment). The impacts of up to 3 treatments were also assessed starting with the initial treatment, adding a second 10 years after the first, and then adding another treatment 10 years after the second. The expected volume gains (recovered log volumes) associated with each analysis unit and treatment combination (treatment regimen) are shown in the graphs below.

Only lodgepole pine, interior spruce, interior Douglas-fir and subalpine fir were represented as having a (positive) response to fertilization.

There are no assumptions relating to an increase in site index in response to fertilization. All responses were gauged with respect to the base case managed stand yield curves, with all of the site index and stocking assumptions inherent in the construction of the original set of yield curves by analysis unit. However, as indicated above, the effect of fertilization is to accelerate the rate of stand development by five years over a 10 year period, with this point representing the maximum response. There is an attendant maximum increase in height 10 years after fertilization, proportional to a 5-year increase in the rate of stand development. In essence the gain in height depends on when fertilization is applied, and the site index of the species in a given analysis unit to which it was applied. Beyond that point of maximum response the fertilizer response dissipates (i.e. the response is less than the maximum of a 5 year acceleration in the development of the stand, 10 years after the fertilizer was applied), unless the stand receives another application of fertilizer.

Economic Analysis

Economic analysis was completed with reference to the incremental gains in recovered log volume by log grade, in each year, following the initial application of fertilizer. Incremental gains were estimated by subtracting the estimated volumes at a given age for the treated stands from the estimated volumes for the same ages in the untreated stands. Fertilization cost was estimated at 425 $/ha. This cost of fertilization was deemed to have occurred in the year of application. Log values were estimated at: 113,

91, 69, 55, 53, and 52 dollars per cubic metre for each of H, I, J, U, X, Y log grades respectively, these being equal to average log prices for HemBal on the Vancouver Log Market (derived from the Help Menu in TIPSY v. 4.1). These revenues would be accrued when the stand is to be harvested at a given age. The purpose of the analysis was to investigate when it would be most appropriate to harvest given certain minimum financial and physical (volume) requirements.

The Internal Rate of Return (IRR) and Net Present Value (NPV) at 2 % discount rate were calculated for each year following application of the first fertilizer treatment. Beyond that costs were deemed to have occurred in each year in which additional treatments were applied, according to the fertilization regime. Graphs illustrating the IRR's associated with each analysis unit – fertilization regime combination are included below.

Finally, a harvesting window was identified for each fertilization regime, wherein a minimum of a 2% internal rate of return must be obtained in order for the treatment to be identified as being successful (Table 1). The associated total merchantable log volumes were also identified and compared with volumes and timing of the maximum mean annual increment and so too of the maximum current annual increment.

Existing Natural

Growth and Yield

At this time there is limited information volume gain from late rotation fertilization and spacing. Information from the Type 1 100 Mile House Analysis was incorporated into this analysis. Table 3 lists the anticipated gains from fertilization and spacing treatments. It was assumed that only one fertilization and spacing treatment would be applied.

Table 3. Expected gain from existing natural silvicultural regimes.

Analysis Unit #	AU Description	Fd Gain (m3/ha) Per Application	Sx Gain (m3/ha) Per Application
2	Douglas-fir, poor	17	
3	Douglas-fir, good/medium	17	
6	Spruce-balsam		11
7	Spruce-balsam		11
10, 11, 12, 13, 14	Dry-belt fir, selection (IDF)	22.5	

The expected gains were added to analysis unit species volume from the existing natural stand yield tables generated by VDYP.

Economic Analysis

The analysis compared the economic gains from untreated to treated stands. The economic cost parameters used in the existing natural stand analysis are represented in Table 4.

Table 4. Costs associated with existing natural and planted pine regimes.

Activity	Cost ($)
Road Development	800/ha
Tree-to-truck	15.52/m3
Haul	5.86/m3
Overhead	1676/ha
Regeneration	1600/ha
Fertilization	400/ha
Spacing	600/ha

Silviculture costs were assumed to occur in the year of application, which in this case was 2008.

It was assumed that value would be estimated at $100/m3.

Stand net revenue and the IRR were calculated based on the assumed age of harvest. For fertilization it was assumed to be 10 and 20 years following application and for spacing 20 and 30 years following treatment.

Unsalvaged Planted Pine

Growth and Yield

Existing natural pine analysis unit yield tables were generated using VDYP. The yield tables were then adjusted to represent the expected regeneration following MPB attack. As noted above the adjustments were based on natural regeneration potential. The planted pine yield table were generated with TIPSY. The regeneration assumption assumed a planting density of 1800 stems/ha for analysis unit 8 (poor site) and 1600 stems/ha for analysis unit 9 (good/medium site) (Table 5).

Table 5. Planted pine regeneration assumptions.

Analysis Unit #	AU Description	ITG	Site Index	Density	Regen Delay
8	Lodgepole pine, poor	28-32	>7.6 <=12.5	1800	5
9	Lodgepole pine, good/medium	28-32	>12.5	1600	5

Existing natural pine analysis unit yield tables were generated using VDYP. The yield tables were then

Economic Analysis

The analysis also compared the economic gains from untreated to treated stands. The economic cost parameters used in the planted pine analysis were the same as the existing natural stand analysis.

The year of planting was assumed to be 2008 and stand value was set to $100/m3.

Stand revenue and the IRR were calculated based on the assumed age of harvest which in this case was when a stand reach 65 m3/ha.

Results & Discussion

Existing and Future Managed

The results are presented in the accompanying figures and tables and for self explanatory. In all cases the year in which the maximum MAI is obtained is outside of the estimated window available for harvesting based on the requirement to obtain a minimum IRR of 2%. In most cases, the maximum CAI is within the window for those fertilization regimes that have acceptable rates of return. A few regimes have maximum periodic increments that immediately precede the window, and few have maximum values that are well beyond the last available harvest date based on the IRR criteria.

In reviewing the graphs and tables it should be noted that some of the early gains in merchantable volume seem quite large. This is because the acceleration of stand condition development associated with fertilization ensures that more volume becomes merchantable earlier during the course of (early) stand development. The site indices shown in Table 1 are only provided as a reference, particularly for representing the current stand conditions, since these are made up of a number of different species, with different site indices.

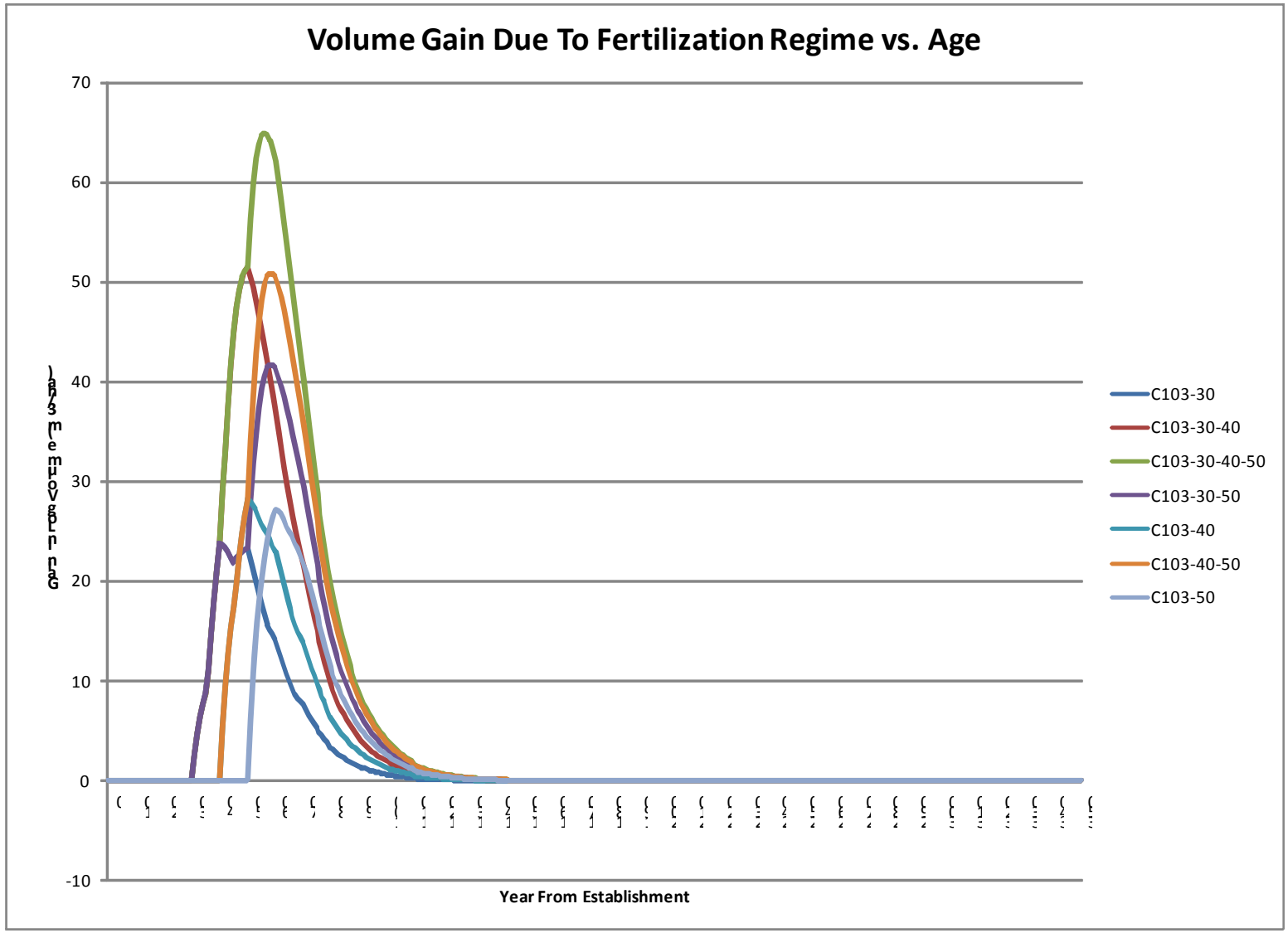
One of the questions that will arise when reviewing the gains in volume associated with fertilization, is why does the gain eventually dissipate to near zero, and is this realistic? Carlson et. al. (2008) recently reviewed modeling approaches to fertilizer response in loblolly pine[2]. They noted that there are two types of responses, with a type A response involving responses involving a nutrient addressing a nutrient deficiency, such the application of the nutrient leads to a sustained period of increased growth. A type B response involves responses when a limiting resource is made available and the elevated resource improves growth for a short period of time. A Type C response is one transient and disappears in years immediately after treatment so that no response is evident when the stand reaches rotation age. They observed a factorial experiment involving phosphorous and nitrogen. In general, height and basal area responses in terms of an age shift over a 10-year period were observed to reach a maximum and then either remain constant or declined. In terms of volume, age shifts increased linearly throughout the 10 year period for most treatments, with the rate of increase being a function of the elements applied, stocking, site index and age at fertilization. However, for those treatments involving fertilization of nitrogen only, the response tended to reach a maximum (be convex) over a 10 year period, with some indication of decline at the lowest rate of N-fertilization (112 kg N ha^{-1}).

Given that a 10 year response time represents ½ to 1/3 of a typical rotation period for loblolly pine, it would appear that it is reasonable to assume in the BC interior case that the gains realized over a 10 year period following treatment, probably decline to something close to zero over an ensuing 50 years in accord with a Type C response pattern. Notwithstanding consideration of the biological response to fertilization, the uncertainties as to whether or not managers will be able to capitalize on such gains, given the potential for changes in the social, economic and environmental conditions, suggests that perhaps it is prudent to assume that the observed gains after a 10 year period are not likely to persist much beyond that period of time. Further to this, some of the volume gains resulting from fertilization

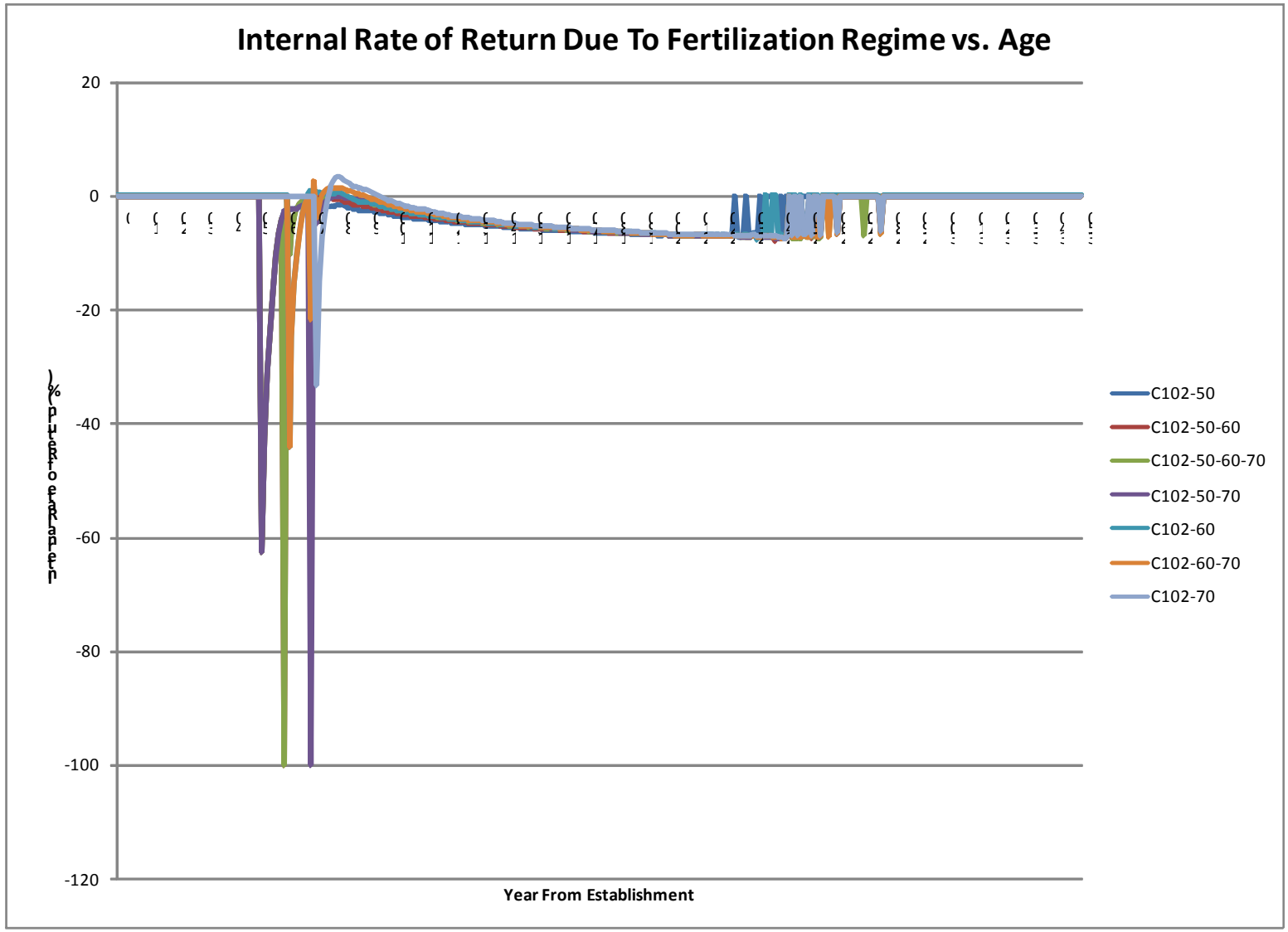
[2] Carlson, C.A., T.R. Fox, H.L. Allen, T.J. Albaugh. 2008. Modeling mid-roation fertilizer responses using the age shift approach. Forest Ecology and Management 256:256-262.

appear large, but are only available within a very short period of time. Within the context of the scenario's considered below, it would seem that in most cases harvesting would be held back until the latest possible, economically acceptable date.

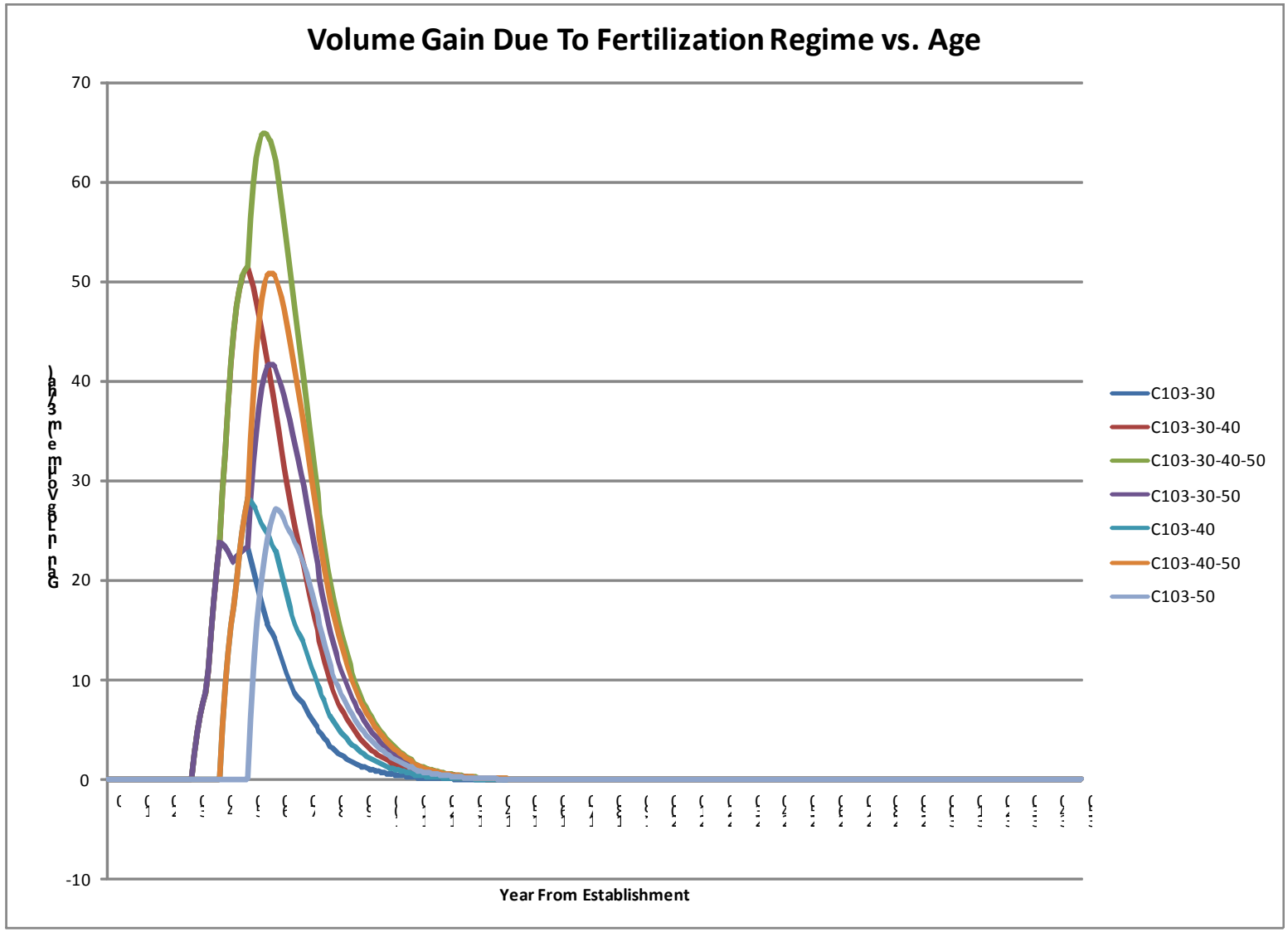
Analysis Unit 102: Current Stand Volume Gain vs. Age



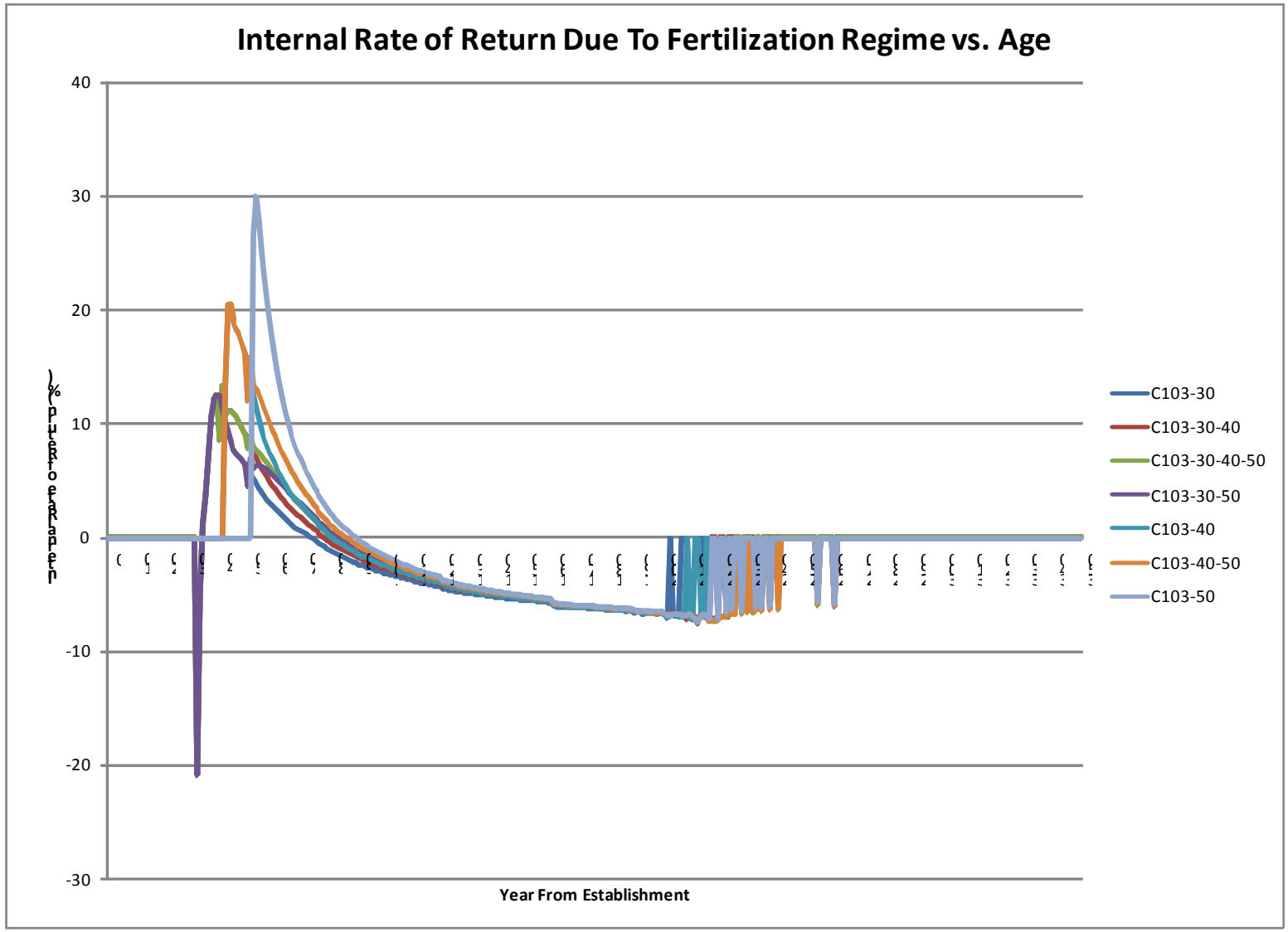
Analysis Unit 102 – Current Stand Internal Rate of Return vs. Age



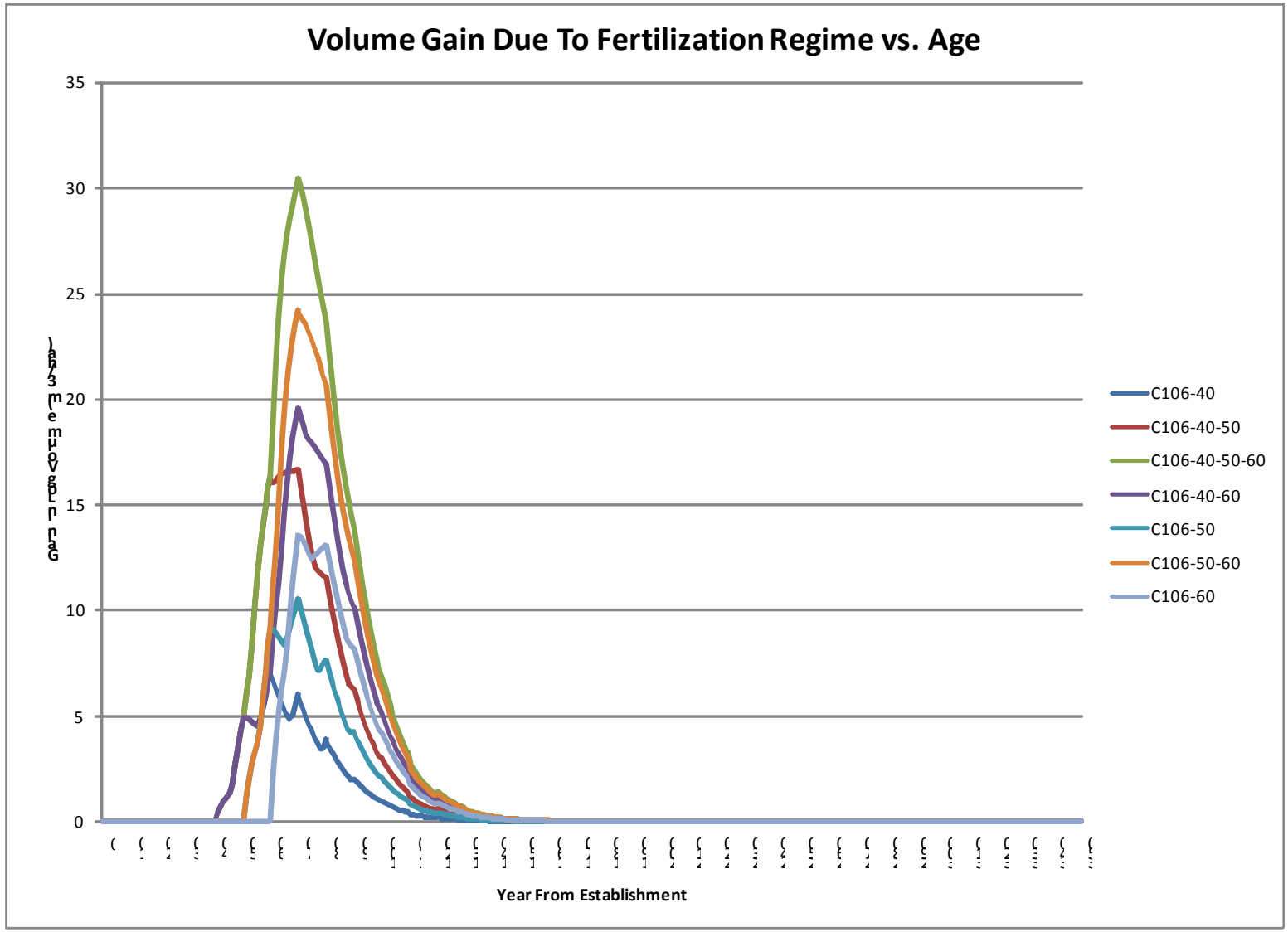
Analysis Unit 103: Current Stand Volume Gain vs. Age



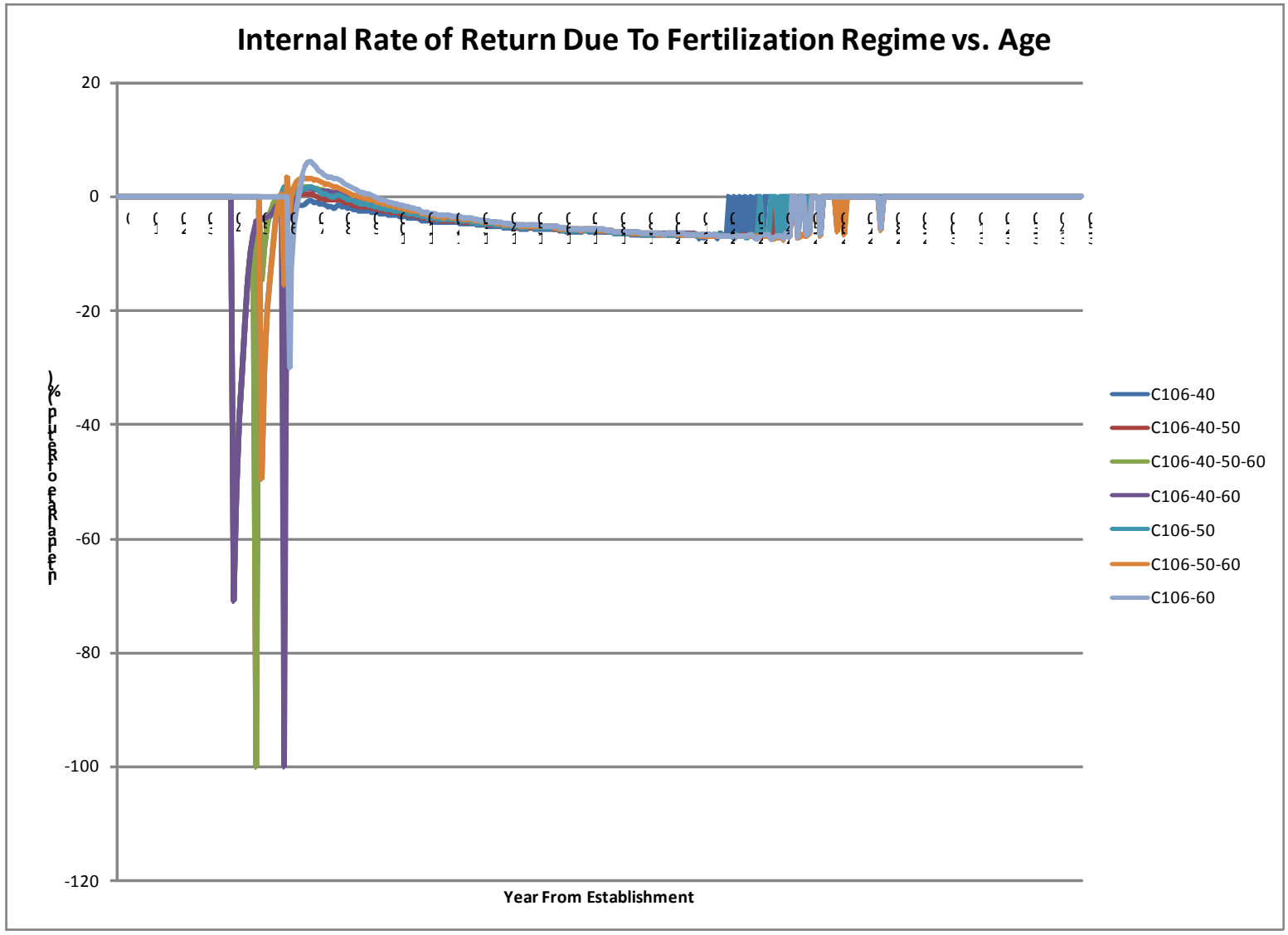
Analysis Unit 103 – Current Stand Internal Rate of Return vs. Age



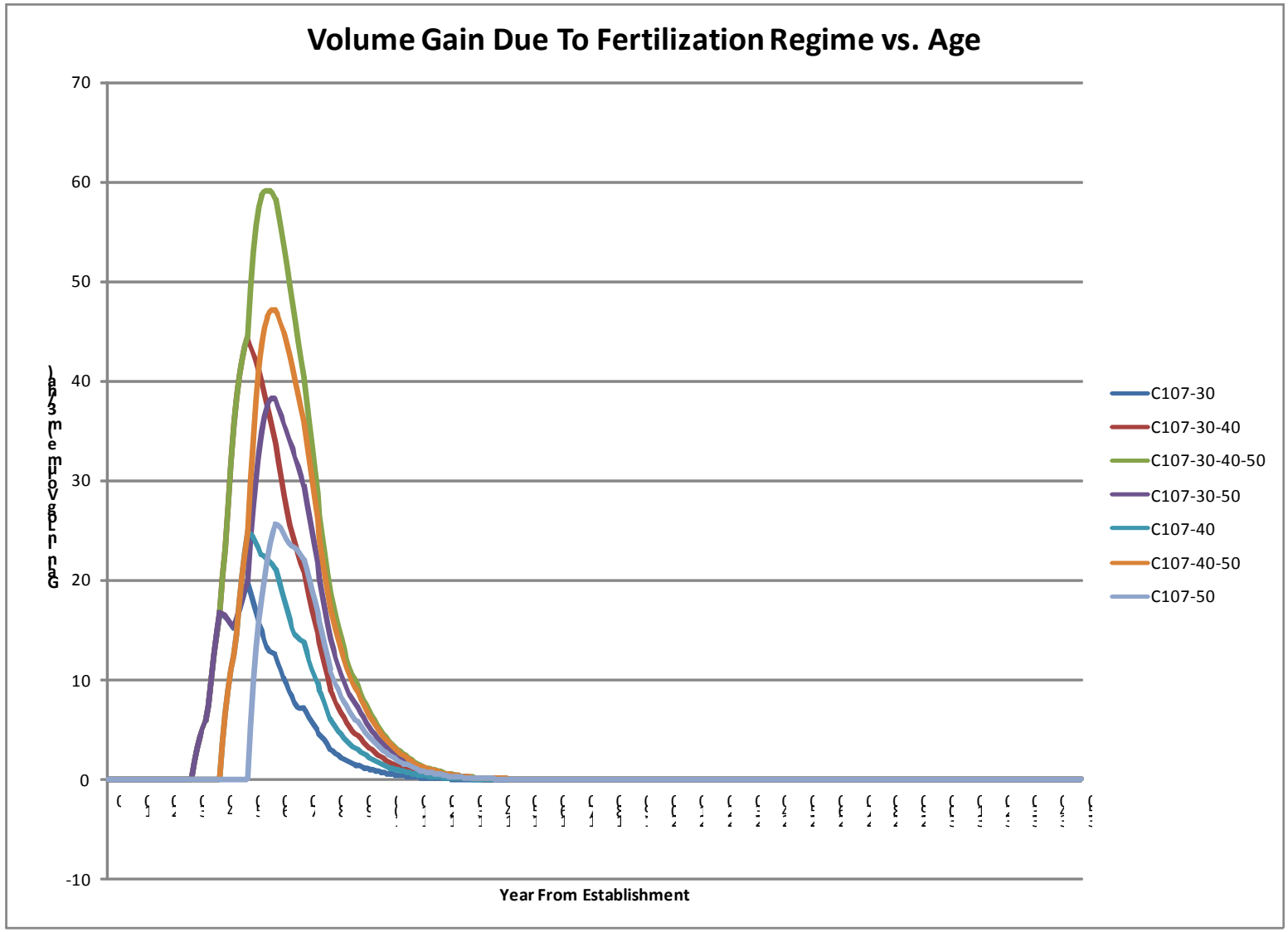
Analysis Unit 106 – Current Stand Volume Gain vs. Age



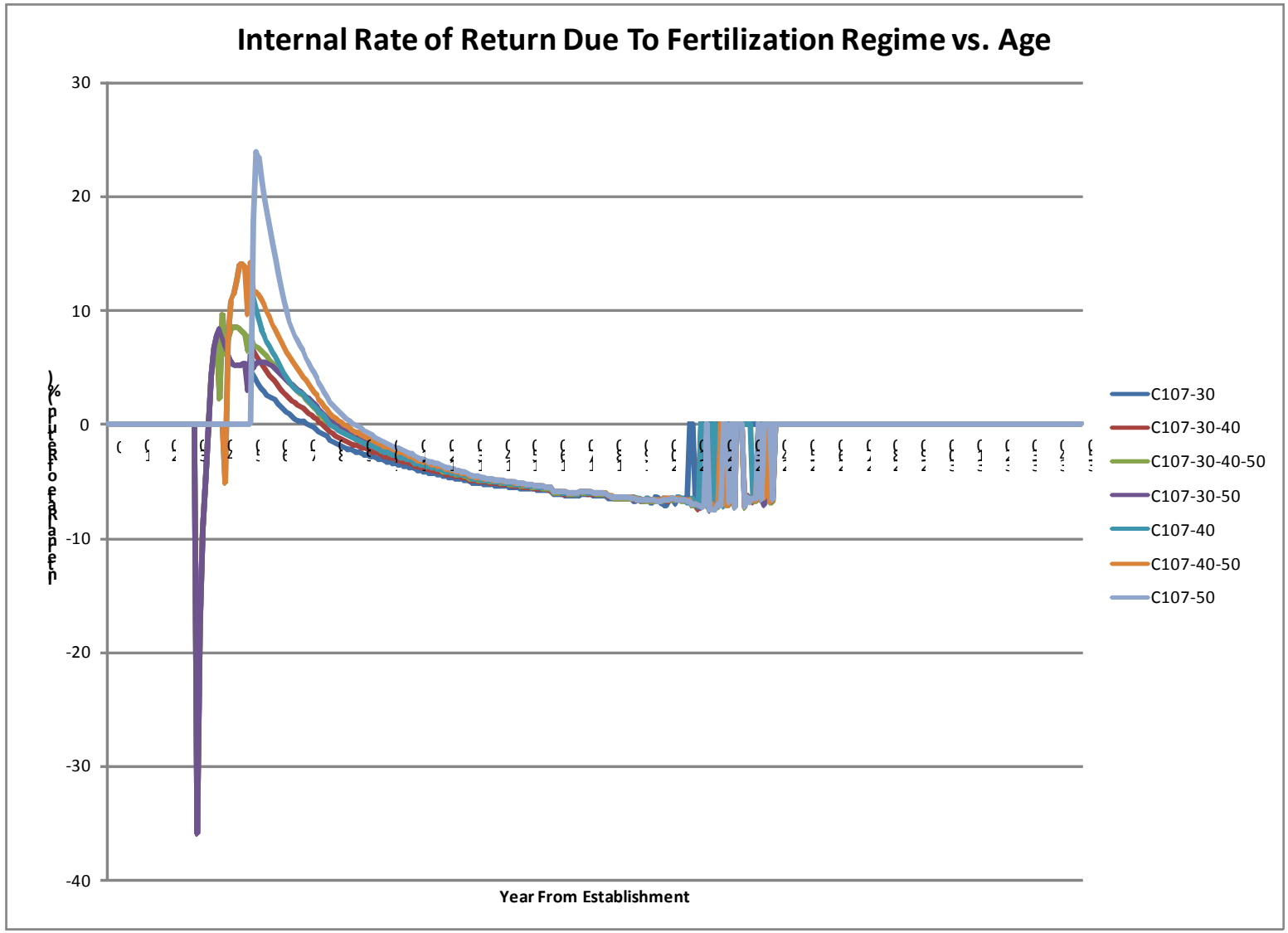
Analysis Unit 106 – Current Stand Internal Rate of Return vs. Age



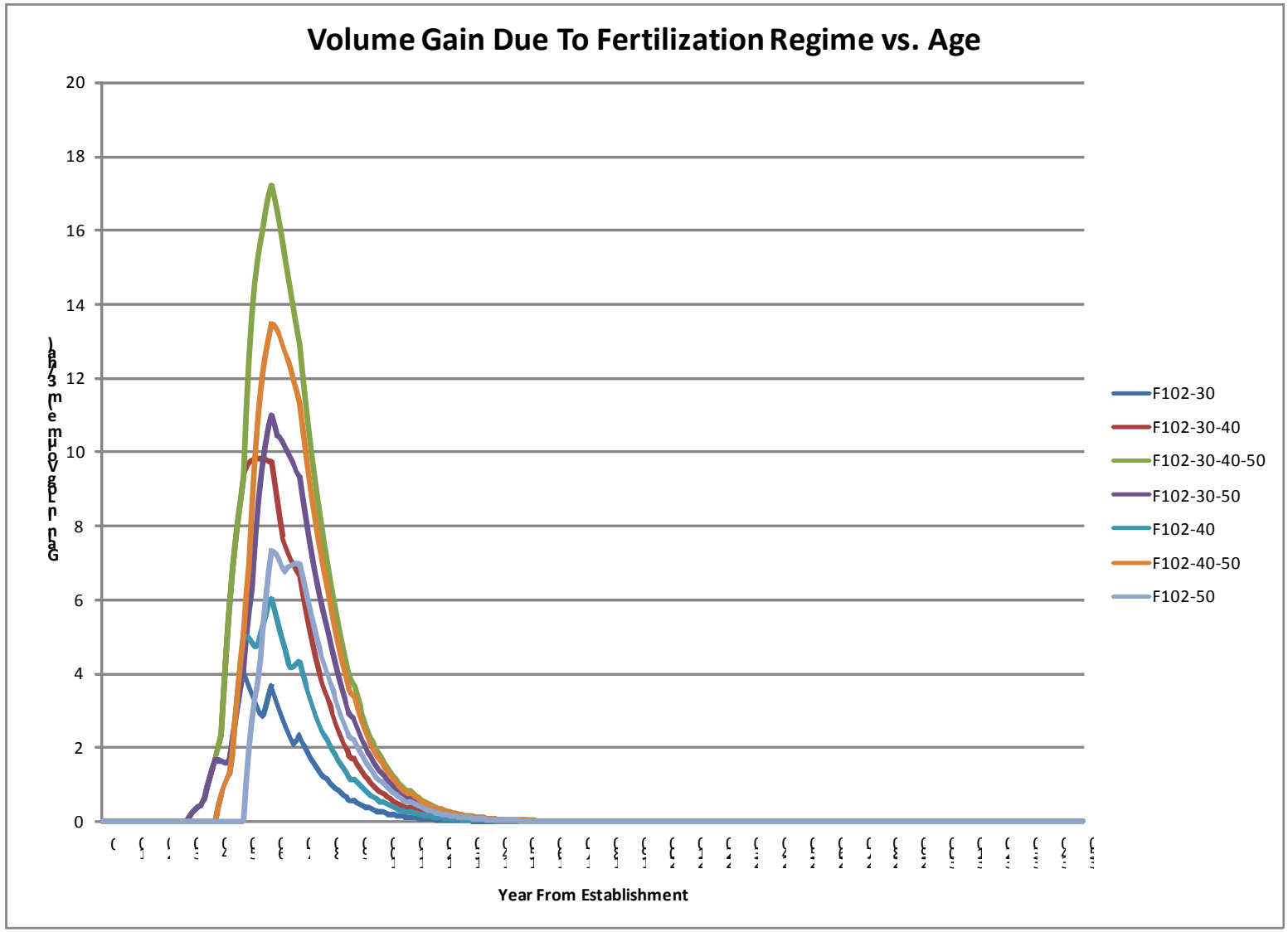
Analysis Unit 107 – Current Stand Volume Gain vs. Age



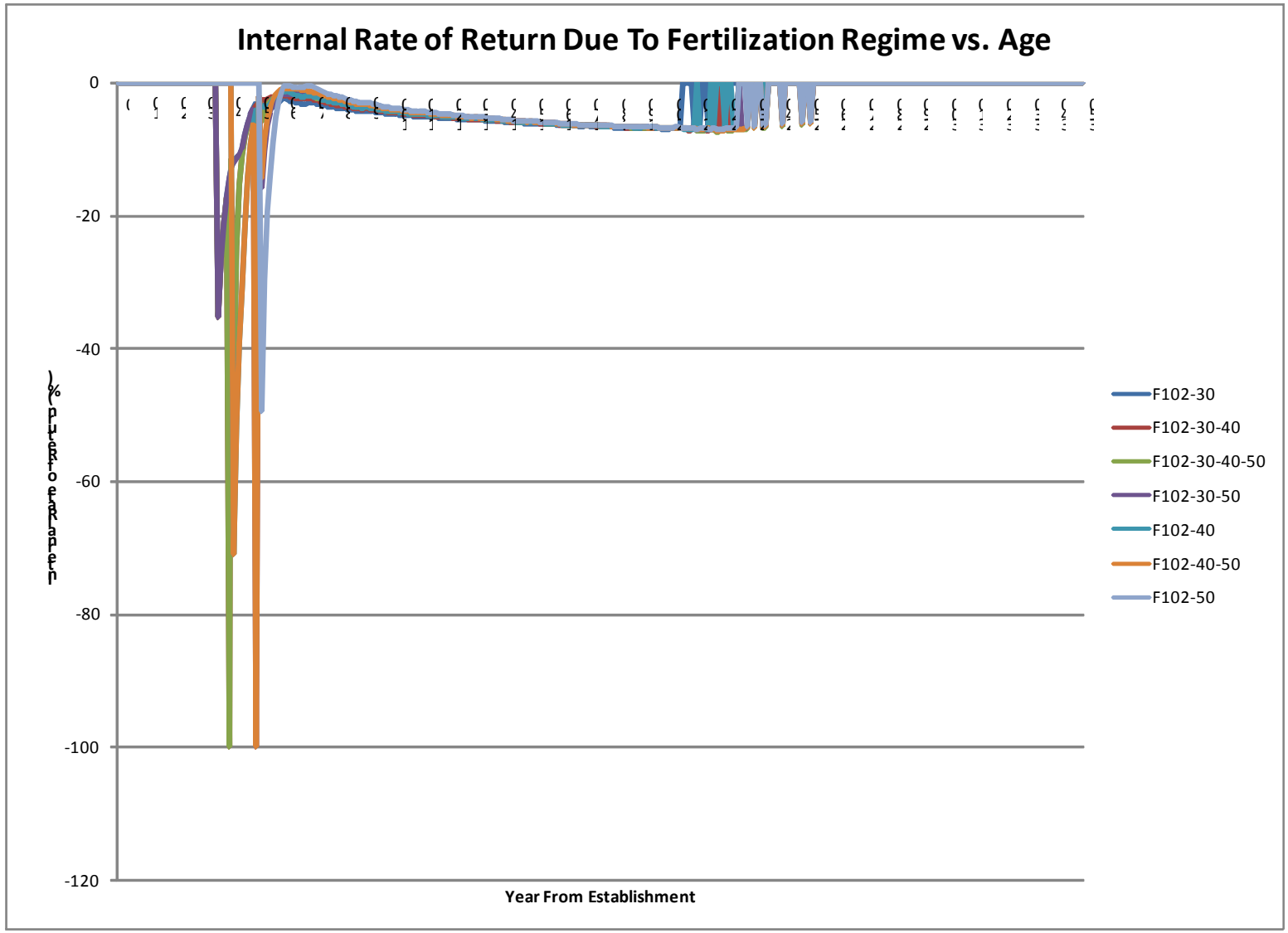
Analysis Unit 107 – Current Stand Internal Rate of Return vs. Age



Analysis Unit 102 – Future Stand Volume Gain vs. Age



Analysis Unit 102 – Future Stand Internal Rate of Return vs. Age



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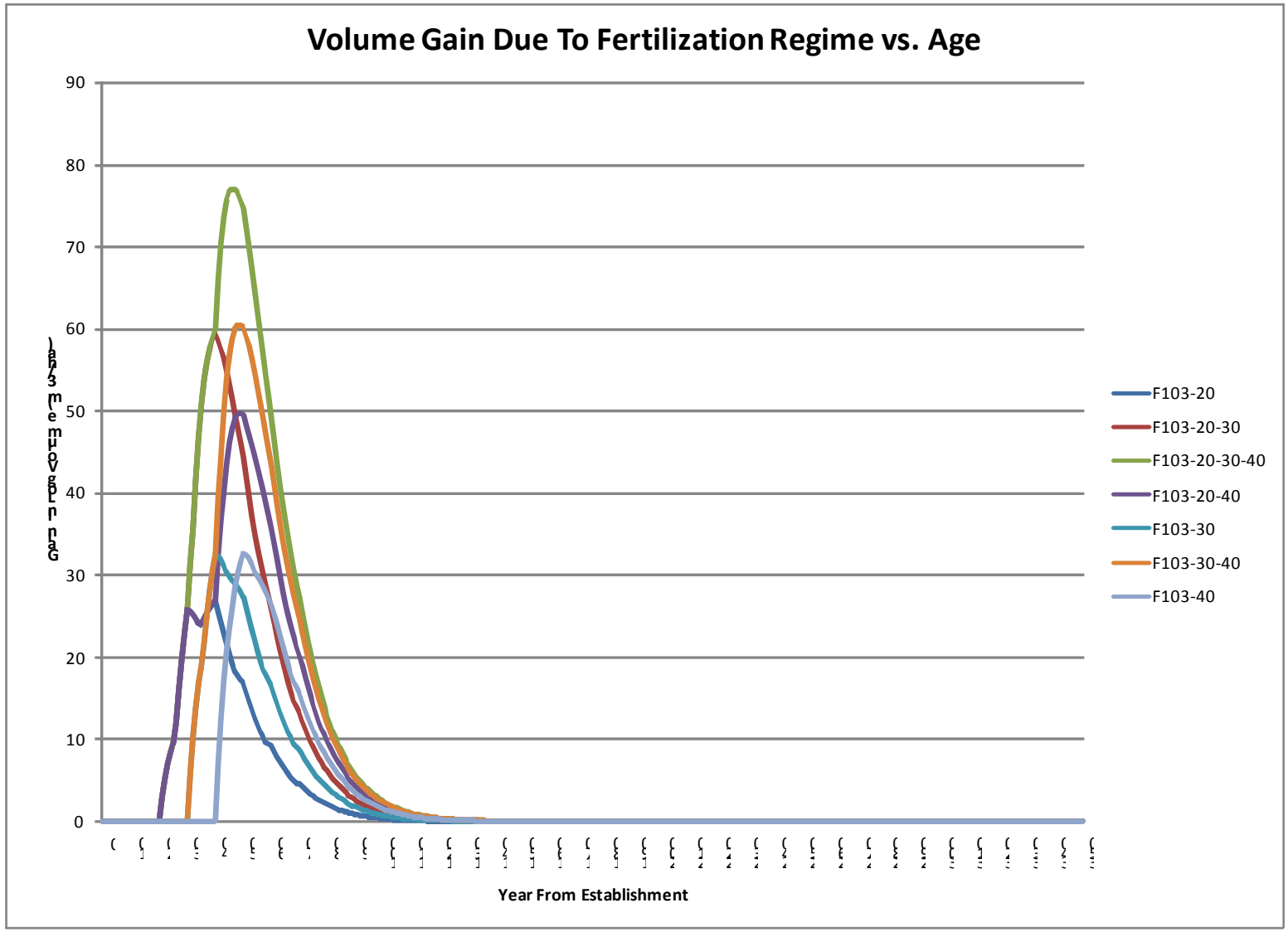

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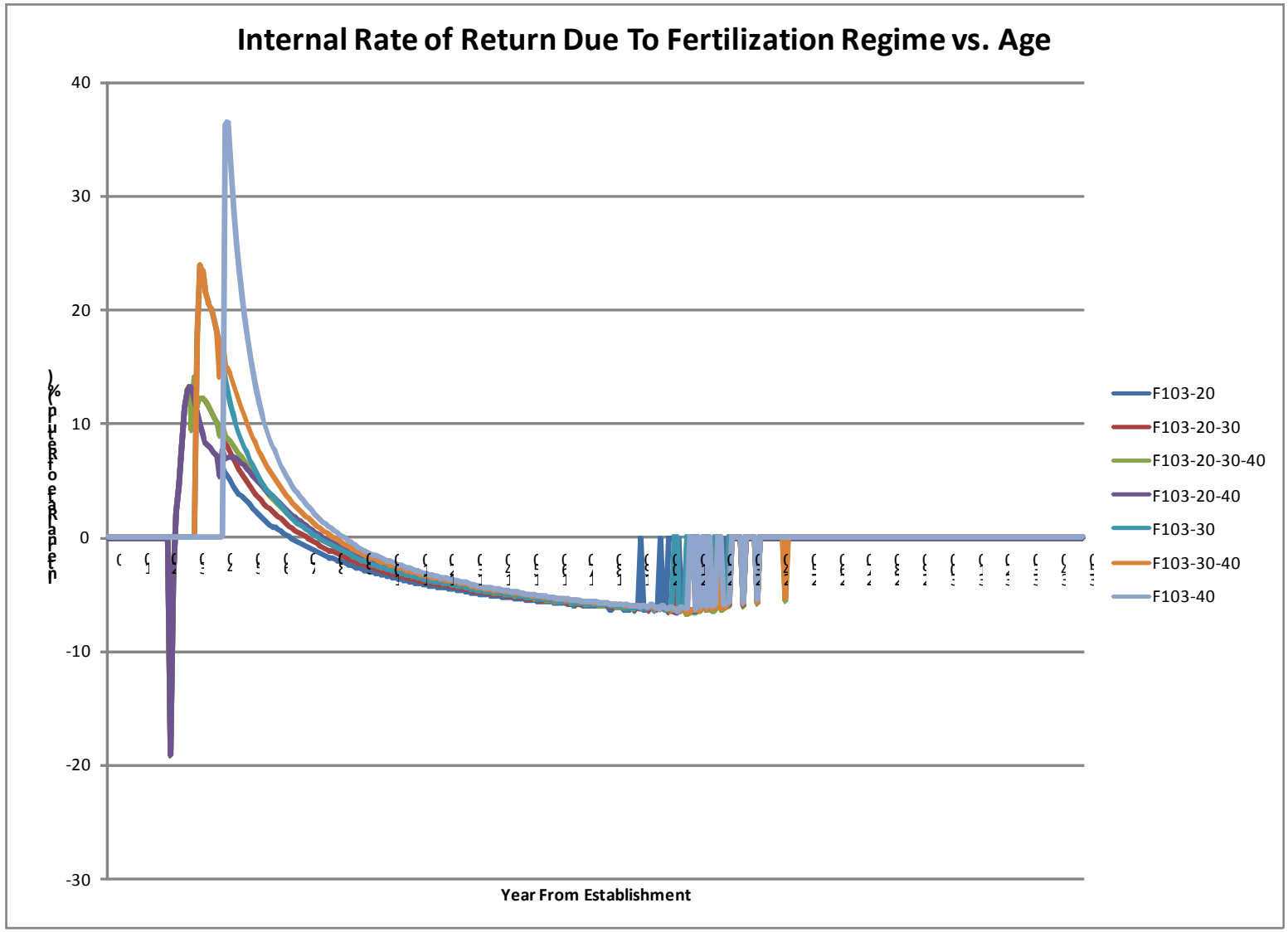

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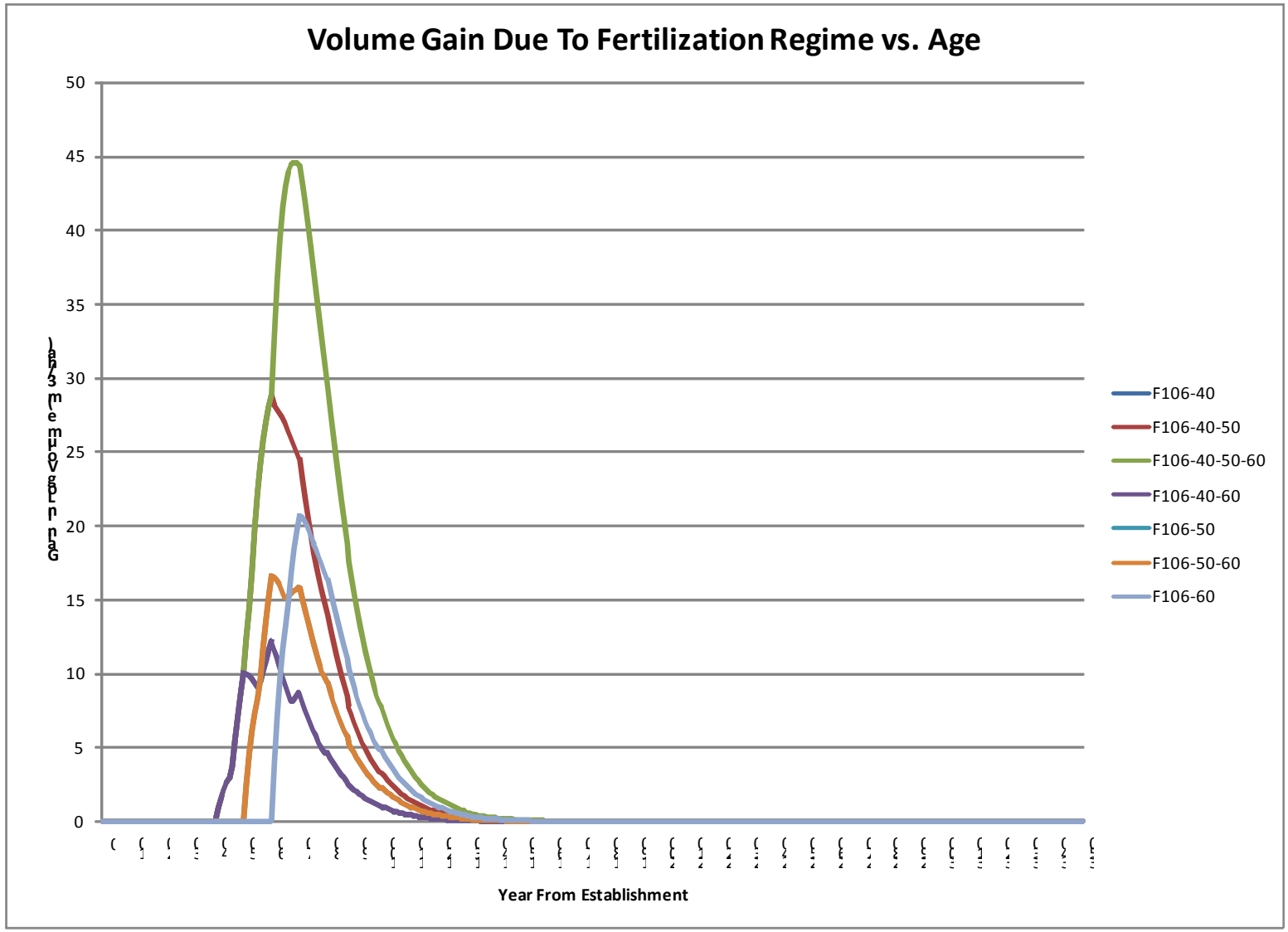

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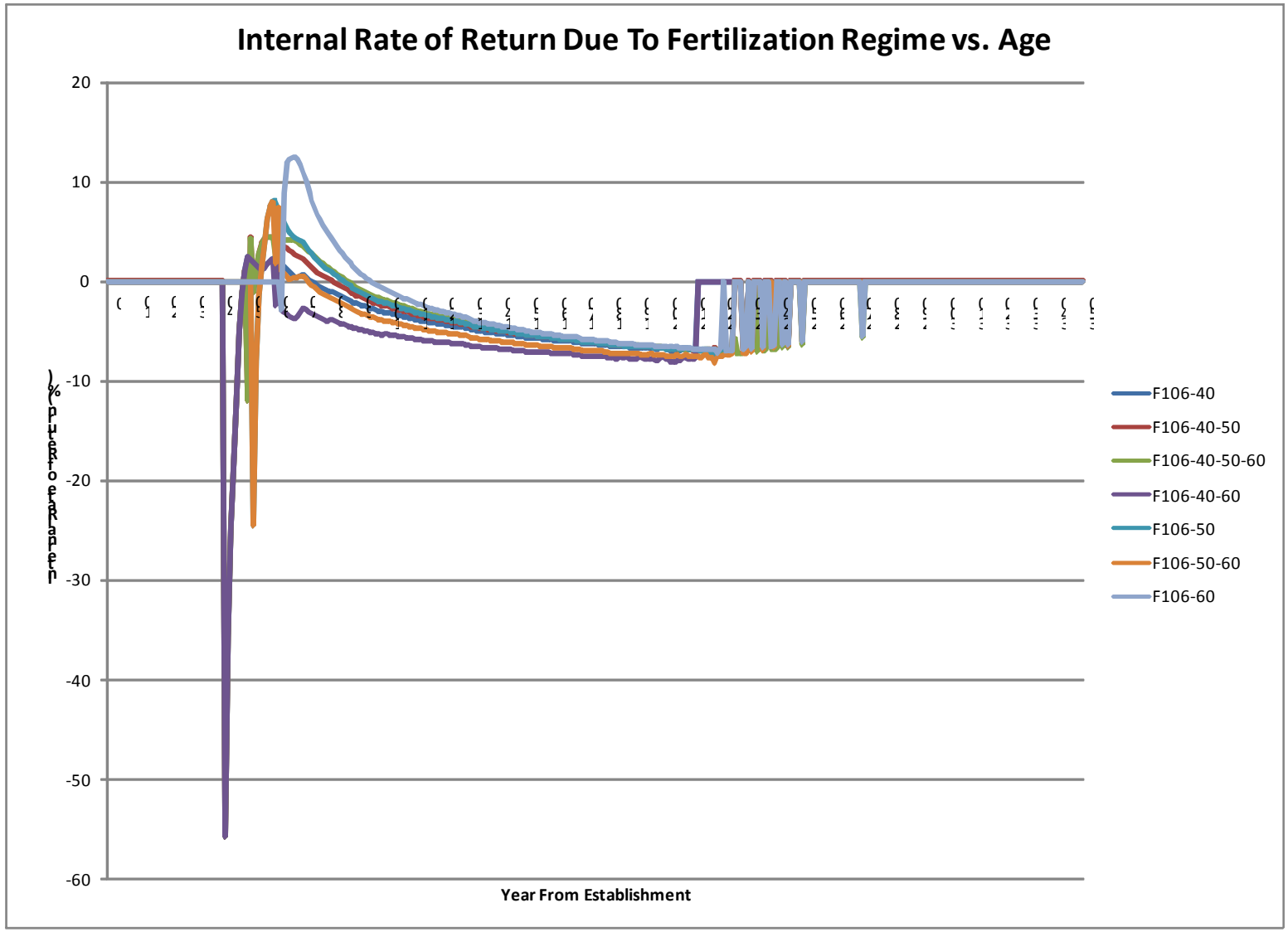

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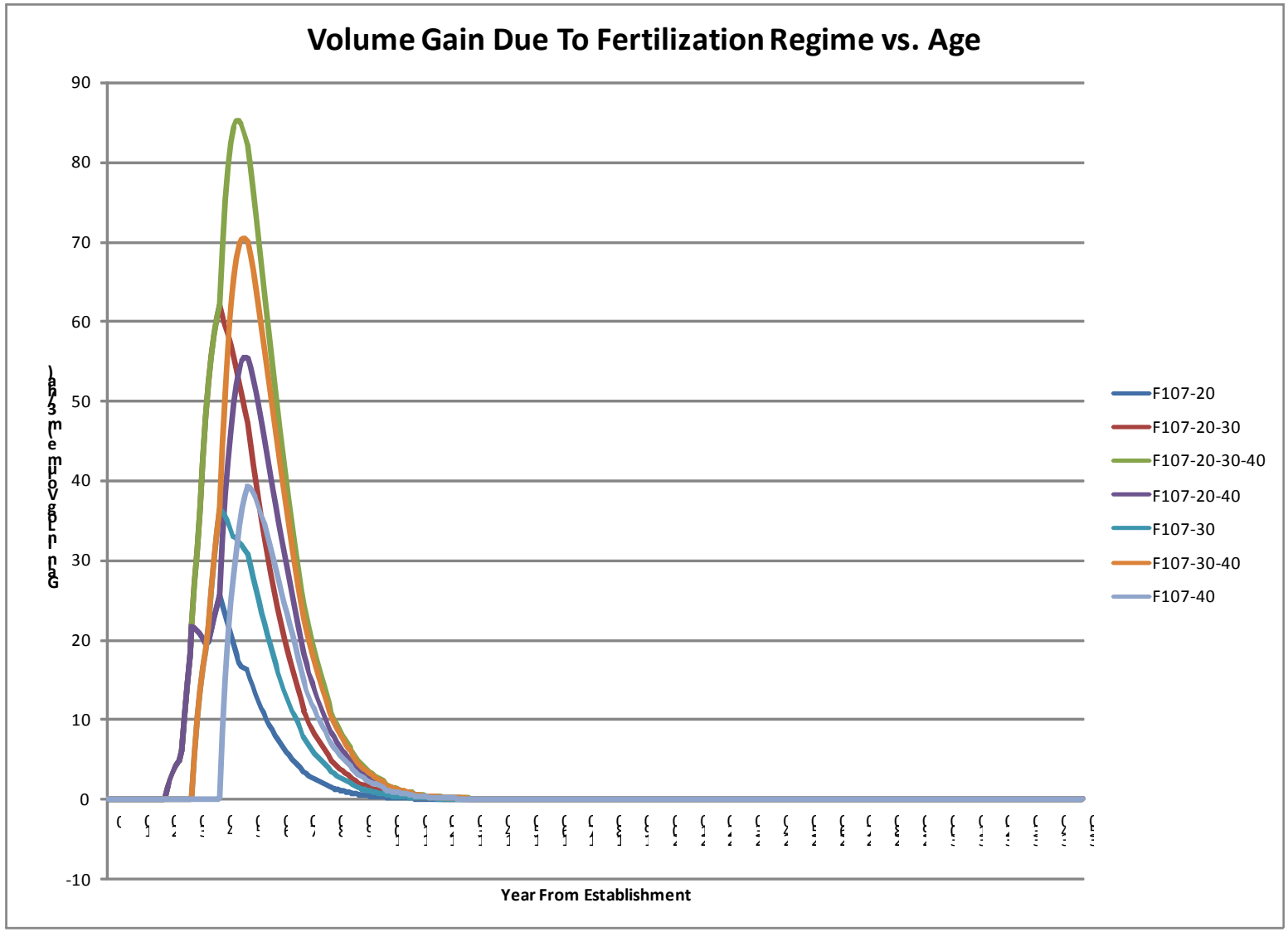

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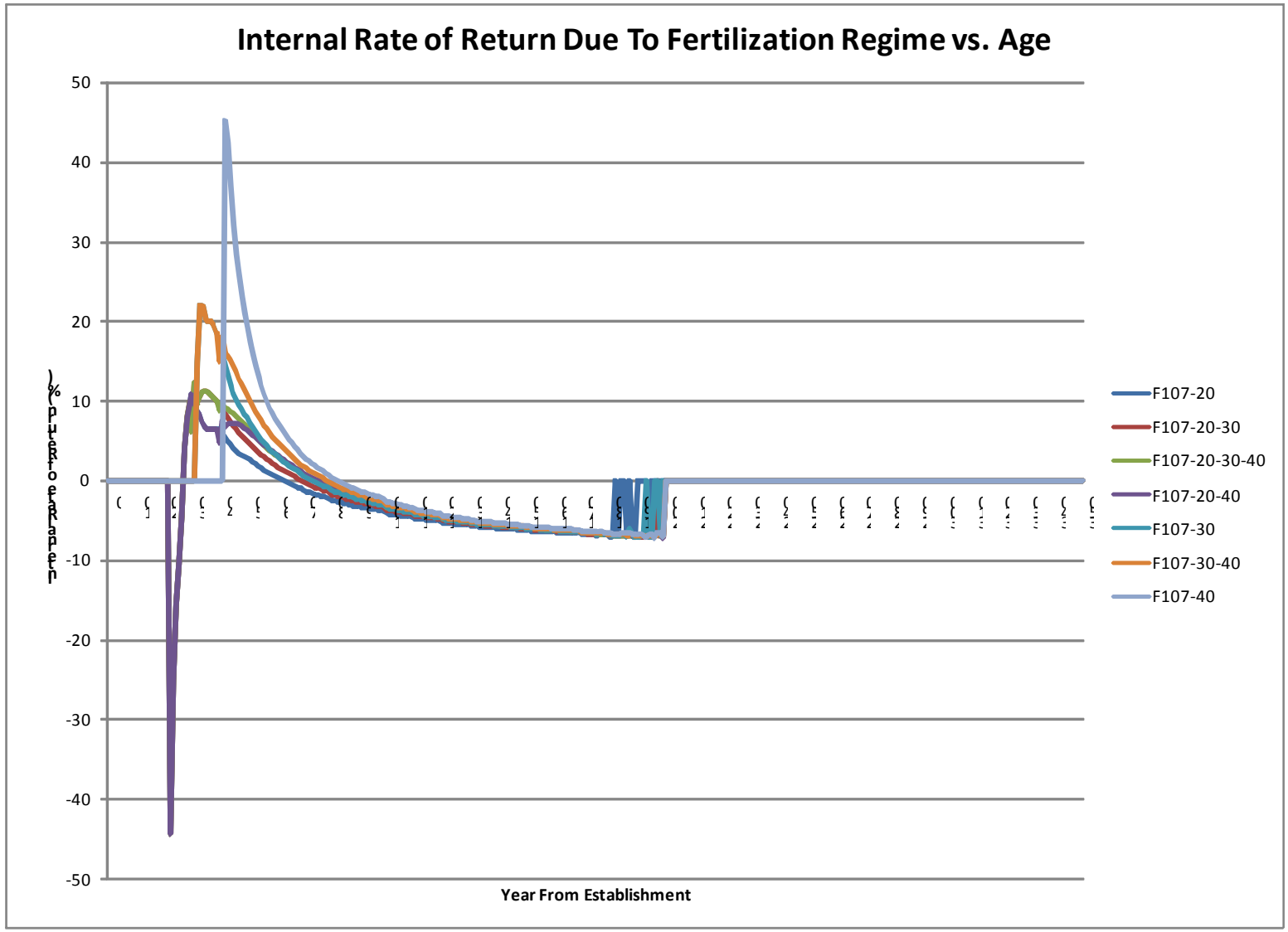

Table 6. Earliest and latest year stands are available for harvest by analysis unit and treatment regime(label), and associated merchantable volumes (12.5 cm dbh+), given that stands must obtain a minimum Internal Rate of Return of 2%. Also shown are the maximum internal rate of return (MIRR) and the year in which it is obtained, the maximum mean annual increment (MMAI, $m^3ha^{-1}y^{-1}$) and maximum current annual increments (MCAI).

Scenario	Label	SI	EYEAR	LYEAR	EVOL	LVOL	MIRR	YEAR	MMAI	YEAR	VOL	MCAI	YEAR	VOL
1	C102-50[3]	12					-0.79	70	1.43	130	186	2.79	91	88
2	C102-60	12					0.82	70	1.43	130	186	3.30	61	16
3	C102-70	12	78	83	60	74	3.31	80	1.43	130	187	4.20	71	36
4	C102-50-60	12					-0.09	70	1.43	130	186	3.27	61	22
5	C102-60-70	12	71	71	44	44	2.68	71	1.44	130	187	4.17	71	44
6	C102-50-70	12					0.30	71	1.44	130	187	3.88	71	42
7	C102-50-60-70	12					0.75	71	1.44	130	187	4.48	71	51
8	C103-30	18	35	62	31	171	12.54	39	3.39	104	352	6.47	37	42
9	C103-40	18	42	72	55	227	20.53	44	3.39	103	350	10.63	41	46
10	C103-50	18	52	80	110	269	29.95	53	3.41	95	324	12.35	51	99
11	C103-30-40	18	35	67	31	213	13.36	41	3.40	97	330	10.52	41	69
12	C103-40-50	18	42	76	55	261	20.53	44	3.45	80	276	12.22	51	121
13	C103-30-50	18	35	73	31	246	12.54	39	3.42	90	308	11.19	51	121
14	C103-30-40-50	18	35	71	31	247	13.36	41	3.50	64	224	11.19	51	150
15	C106-40	12					-0.42	60	1.62	144	234	3.28	91	96
16	C106-50	12					1.78	70	1.62	143	232	3.23	90	95
17	C106-60	12	67	82	36	77	6.17	70	1.62	143	232	4.05	61	17
18	C106-40-50	12					0.48	70	1.62	143	232	3.08	100	127
19	C106-50-60	12	61	76	26	70	3.46	61	1.62	143	232	4.27	64	38
20	C106-40-60	12					1.39	70	1.62	143	232	3.70	65	37
21	C106-40-50-60	12					1.62	70	1.62	143	232	4.73	62	39
22	C107-30	16	37	60	27	123	8.43	40	3.03	110	333	5.20	70	170

[3] This label starts with a letter, “C” or “F”, indicating whether it refers to a current or future stand conditions, followed by a number indicating the analysis unit (e.g. 102), and then a series of dashes and numbers, each of which indicates a year in which a treatment was applied.

Table 6. (continued)

Scenario	Label	SI	EYEAR	LYEAR	EVOL	LVOL	MAXIRR	YEAR	MAXMAI	YEAR	VOL	MAXPAI	YEAR	VOL
23	C107-40	16	43	71	43	182	14.06	48	3.03	110	334	7.55	41	30
24	C107-50	16	52	79	79	224	23.86	53	3.04	109	331	10.77	51	70
25	C107-30-40	16	37	66	27	167	9.67	41	3.03	109	331	8.16	44	69
26	C107-40-50	16	43	76	43	220	14.18	51	3.04	107	326	10.65	51	94
27	C107-30-50	16	37	72	27	201	8.43	40	3.04	108	328	9.78	51	89
28	C107-30-40-50	16	37	71	27	207	9.67	41	3.05	106	323	10.08	51	114
29	F102-30	11					-2.42	60	0.87	160	139	1.43	91	57
30	F102-40	11					-1.19	60	0.87	160	139	1.38	91	58
31	F102-50	11					-0.45	61	0.87	160	139	2.06	51	6
32	F102-30-40	11					-1.81	60	0.87	160	139	1.56	43	5
33	F102-40-50	11					-0.79	61	0.87	160	139	2.42	53	15
34	F102-30-50	11					-1.65	66	0.87	160	139	2.08	54	15
35	F102-30-40-50	11					-1.46	60	0.87	160	139	2.77	51	16
36	F103-20	20	24	54	19	164	13.29	29	3.78	100	378	6.37	27	33
37	F103-30	20	32	64	44	220	23.88	33	3.79	100	379	10.52	31	35
38	F103-40	20	42	74	95	273	36.55	43	3.80	98	372	13.06	41	83
39	F103-20-30	20	24	60	19	210	14.12	31	3.79	99	375	10.84	33	80
40	F103-30-40	20	32	69	44	260	23.88	33	3.81	95	362	12.91	41	115
41	F103-20-40	20	24	65	19	239	13.29	29	3.80	97	369	11.72	41	109
42	F103-20-30-40	20	24	64	19	245	14.12	31	4.03	50	201	12.23	41	142
43	F106-40	11	50	61	18	43	2.48	50	2.12	149	316	3.71	80	104
44	F106-50	11	56	75	30	92	8.17	60	2.12	149	316	4.48	51	12
45	F106-60	11	63	86	47	134	12.52	67	2.12	149	316	7.20	61	35
46	F106-40-50	11	51	70	22	85	4.40	58	2.12	149	316	5.00	54	36
47	F106-50-60	11	56	61	30	48	8.03	59	2.12	149	316	4.48	51	12
48	F106-40-60	11	50	61	18	43	2.48	50	2.12	149	316	3.71	80	104

Table 6. (continued)

Scenario	Label	SI	EYEAR	LYEAR	EVOL	LVOL	MAXIRR	YEAR	MAXMAI	YEAR	VOL	MAXPAI	YEAR	VOL
48	F106-40-60	11	50	61	18	43	2.48	50	2.12	149	316	3.71	80	104
49	F106-40-50-60	11	51	75	22	117	4.86	61	2.12	148	314	7.21	61	64
50	F107-20	18	27	53	10	27	10.93	30	2.12	149	316	4.38	27	10
51	F107-30	18	32	64	10	54	21.93	34	2.12	149	316	5.63	31	6
52	F107-40	18	42	73	18	84	45.22	42	2.12	149	316	9.05	41	10
53	F107-20-30	18	27	59	10	53	12.30	31	2.12	149	316	6.55	34	43
54	F107-30-40	18	32	69	10	81	21.93	34	2.12	149	316	8.88	41	46
55	F107-20-40	18	27	65	10	71	10.93	30	2.12	149	316	7.77	41	34
56	F107-20-30-40	18	27	64	10	80	12.30	31	2.12	149	316	7.78	41	71

Existing Natural

The results shown in Table 7 demonstrate that in certain cases fertilization regimes will achieve the minimum IRR of 2%. Fertilization of fir stands (AU 2 and 3) achieved the minimum IRR of 2% regardless of if the stand was to be harvest 10 to 20 years following fertilization. In the case of spruce (6 and 7) the minimum IRR of 2% was achieved only when harvested 20 years following treatment. It should also be noted that regimes applied to fir and spruce poor sites provided the highest return on investment (AU 2 versus AU 3 and AU 6 versus 7).

Table 7. Economic and volume results from fertilizing existing natural stands.

Treatment	Harvest 10 Years Following Fertilization		Harvest 20 Years Following Fertilization	
	IRR	Volume (m^3)	IRR	Volume (m^3)
AU 2 - Fert @ Age 80	5.48%	82.54	12.30%	97.04
AU 2 - Fert @ Age 90	5.47%	97.04	12.29%	110.34
AU 2 - Fert @ Age 100	5.46%	110.34	12.28%	122.57
AU 2 - Fert @ Age 110	5.45%	122.57	12.28%	134.16
AU 2 - Fert @ Age 120	5.44%	134.16	12.27%	144.29
AU 3 - Fert @ Age 50	5.38%	201.13	12.21%	246.59
AU 3 - Fert @ Age 60	5.34%	246.59	12.18%	287.31
AU 3 - Fert @ Age 70	5.30%	287.31	12.15%	323.94
AU 3 - Fert @ Age 80	5.27%	323.94	12.12%	356.94
AU 3 - Fert @ Age 90	5.24%	356.94	12.10%	386.74
AU 3 - Fert @ Age 100	5.21%	386.74	12.08%	413.65
AU 3 - Fert @ Age 110	5.19%	413.65	12.06%	439.16
AU 3 - Fert @ Age 120	5.16%	439.16	12.04%	461.43
AU 6 - Fert @ Age 70	1.00%	74.25	8.72%	98.3
AU 6 - Fert @ Age 80	0.98%	98.3	8.70%	120.44
AU 6 - Fert @ Age 90	0.96%	120.44	8.69%	140.82
AU 6 - Fert @ Age 100	0.94%	140.82	8.67%	159.53
AU 6 - Fert @ Age 110	0.92%	159.53	8.66%	177.46
AU 6 - Fert @ Age 120	0.91%	177.46	8.65%	193.71
AU 7 - Fert @ Age 50	0.95%	125.1	8.68%	169.36
AU 7 - Fert @ Age 60	0.92%	169.36	8.65%	208.25
AU 7 - Fert @ Age 70	0.88%	208.25	8.63%	242.4
AU 7 - Fert @ Age 80	0.85%	242.4	8.60%	272.31
AU 7 - Fert @ Age 90	0.83%	272.31	8.58%	298.52
AU 7 - Fert @ Age 100	0.81%	298.52	8.57%	321.48
AU 7 - Fert @ Age 110	0.79%	321.48	8.55%	342.52
AU 7 - Fert @ Age 120	0.77%	342.52	8.54%	360.44

The spacing results are listed in Table 8. In all cases an IRR of 2% is achieved. The highest IRR can be realized if stands are harvested 20 years following treatment.

Table 8 Economic and volume results from spacing existing natural stands.

Treatment	20 Years Following Spacing IRR	20 Years Following Spacing Volume (m^3)	30 Years Following Spacing IRR	30 Years Following Spacing Volume (m^3)
AU 10 - Space @ Age 50	2.55%	94.49	6.76%	115.09
AU 10 - Space @ Age 60	2.54%	115.09	6.75%	134.2
AU 10 - Space @ Age 70	2.53%	134.2	6.75%	151.76
AU 11 - Space @ Age 50	2.57%	36.43	6.79%	45.01
AU 11 - Space @ Age 60	2.57%	45.01	6.78%	53.7
AU 11 - Space @ Age 70	2.57%	53.7	6.78%	61.86
AU 12 - Space @ Age 50	2.54%	102.84	6.76%	121.6
AU 12 - Space @ Age 60	2.54%	121.6	6.75%	138.62
AU 12 - Space @ Age 70	2.53%	138.62	6.75%	154.09
AU 13 - Space @ Age 50	2.56%	58.76	6.78%	76.38
AU 13 - Space @ Age 60	2.56%	76.38	6.77%	92.8
AU 13 - Space @ Age 70	2.55%	92.8	6.76%	107.94
AU 14 - Space @ Age 50	2.52%	155.85	6.74%	184.95
AU 14 - Space @ Age 60	2.51%	184.95	6.73%	211.51
AU 14 - Space @ Age 70	2.50%	211.51	6.72%	235.72

Unsalvaged Planted Pine

Table 9 shows the results for stands planted following attack from MPB. In all cases the minimum 2% IRR is achieved and the highest IRR is dependant on stand age and volume harvested. As expected stands with high regeneration potential have the lowest IRR since the volume expected from these stands is higher compared to moderate and low regeneration potential. For analysis unit 9 (good/medium site) a higher IRR is realized at an earlier age.

Table 9. Age, IRR, and volume for stands reaching 2% IRR and maximum economic return.

Treatment	Age, IRR, Volume when stand reaches 2% IRR Age	IRR	Volume (m^3)	Age, IRR, Volume of Maximum IRR Age	IRR	Volume (m^3)
Plant AU 8 - High Regen Potential	70	2.1%	79	115	3.1%	171
Plant AU 8 - Moderate Regen Potential	65	2.9%	65	155	4.2%	215
Plant AU 8 - Low Regen Potential	65	2.9%	65	160	4.5%	219
Plant AU 9 - High Regen Potential	35	4.3%	78.5	85	6.7%	302
Plant AU 9 - Moderate Regen Potential	35	4.3%	78.5	90	6.9%	314
Plant AU 9 - Low Regen Potential	35	4.3%	78.5	85	7.2%	302